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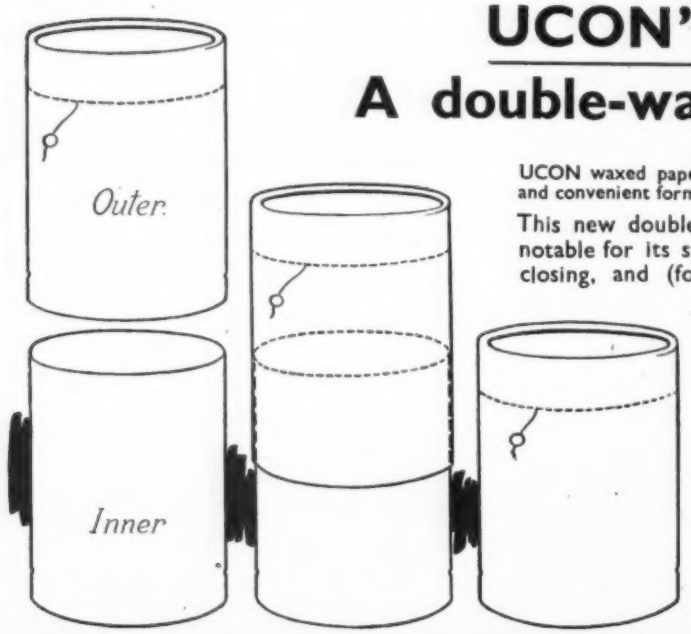

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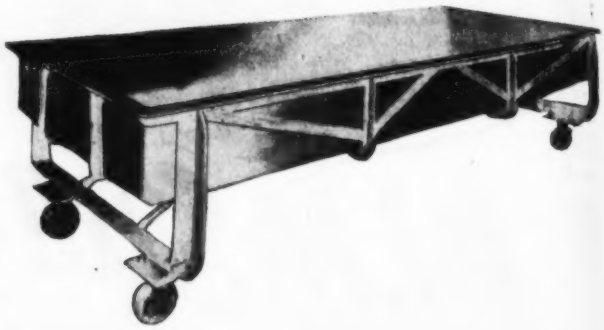

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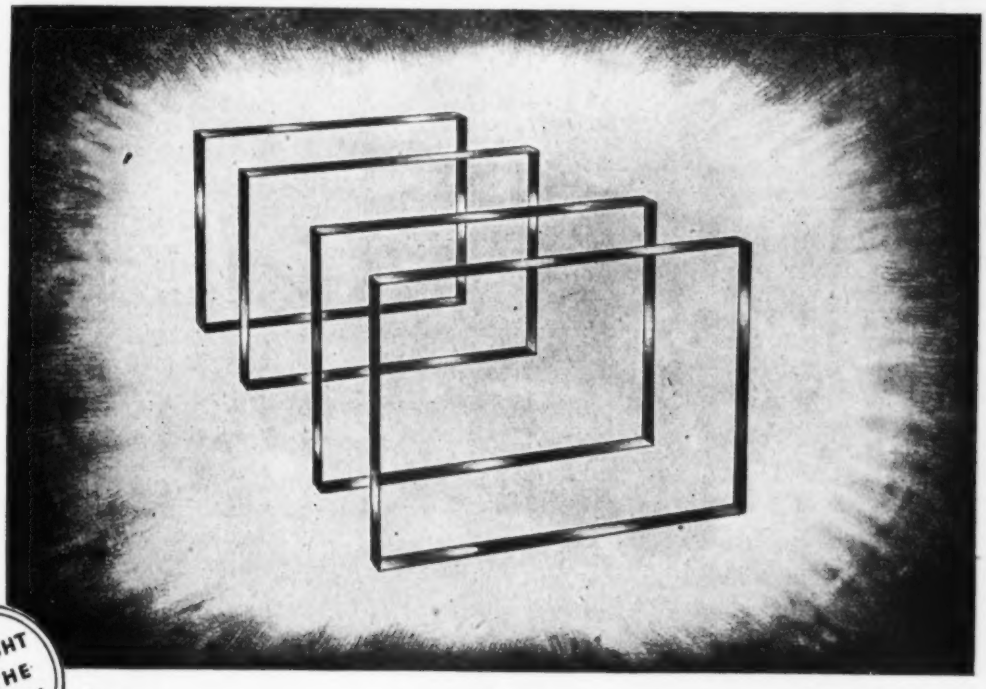

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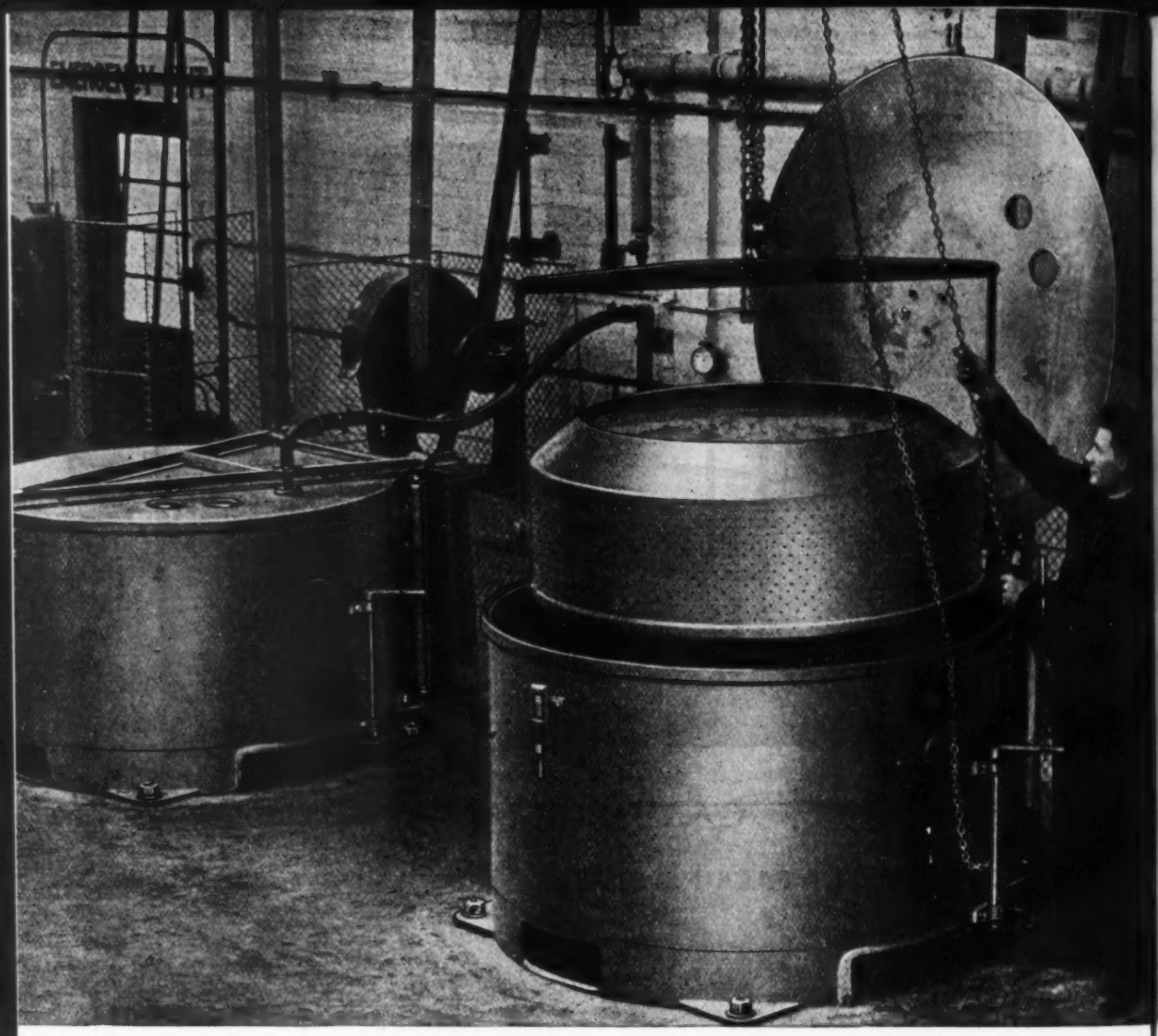

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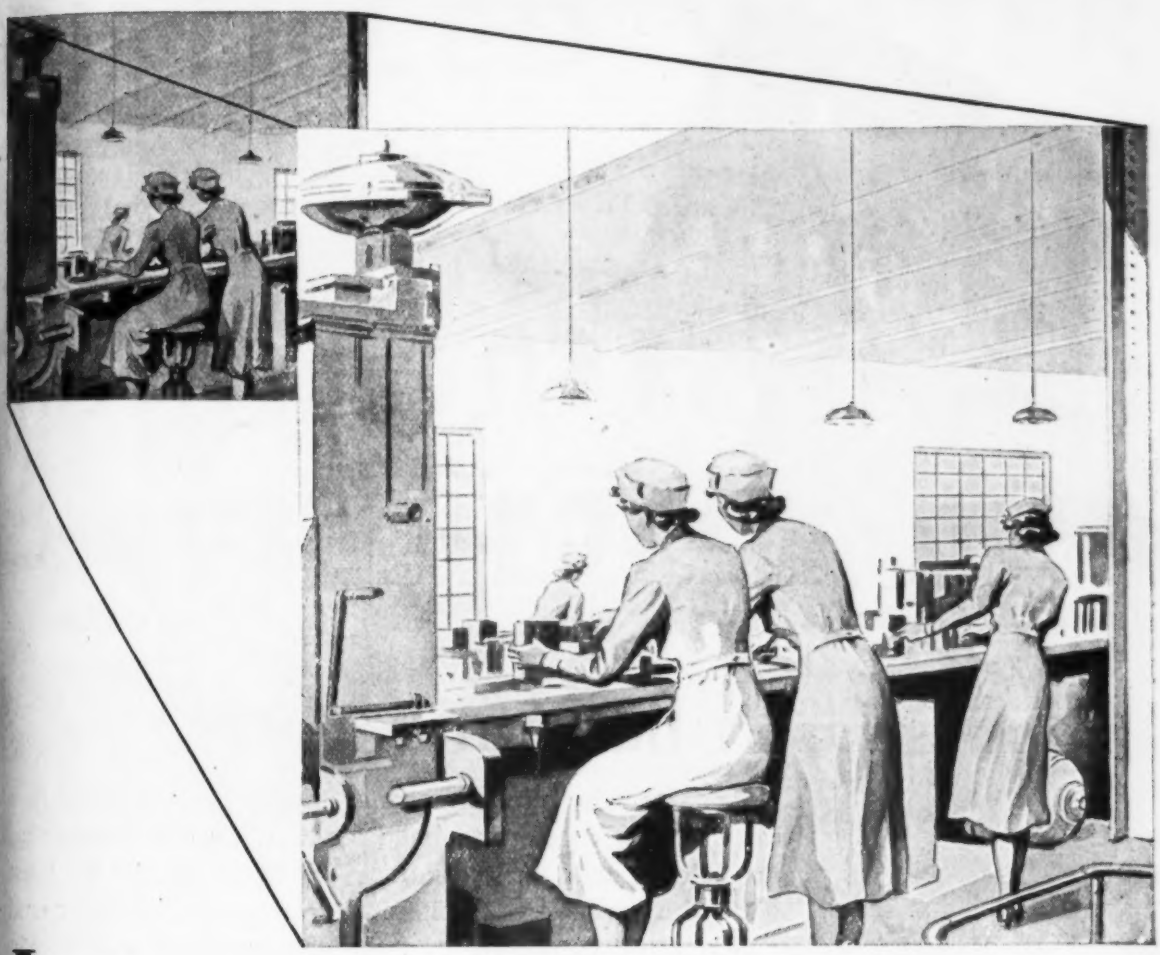

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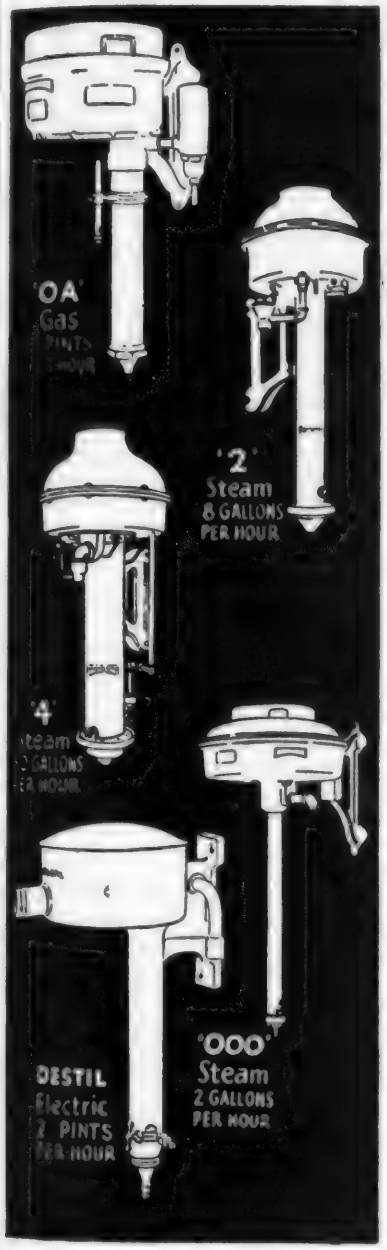

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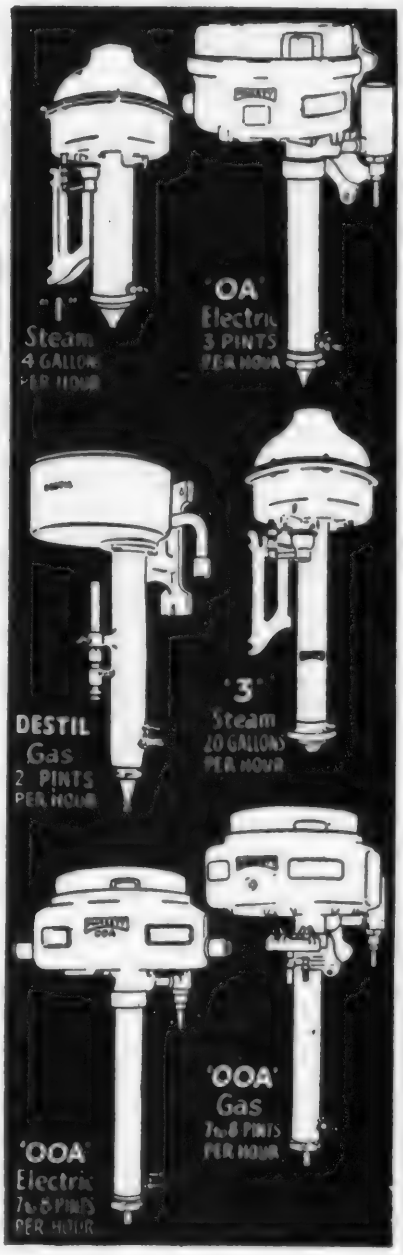

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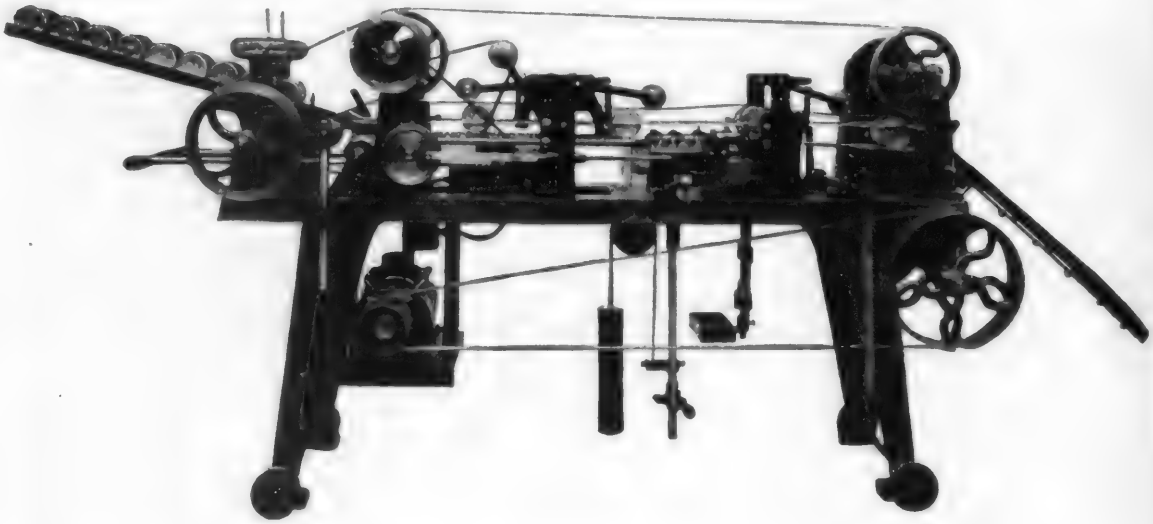

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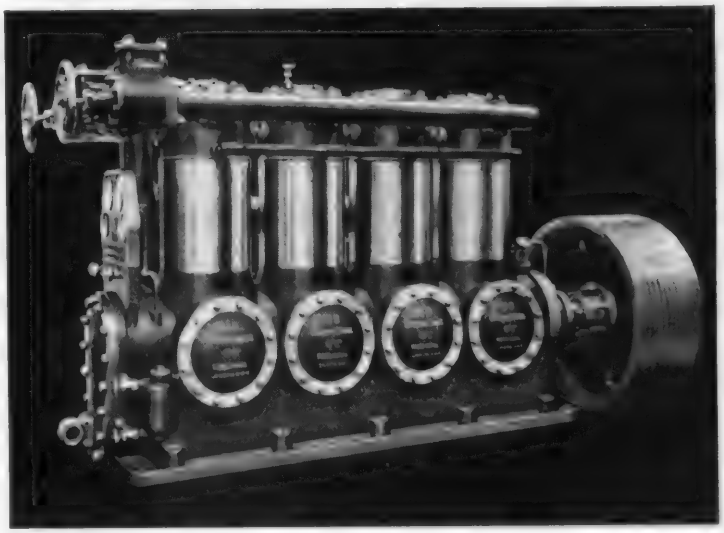

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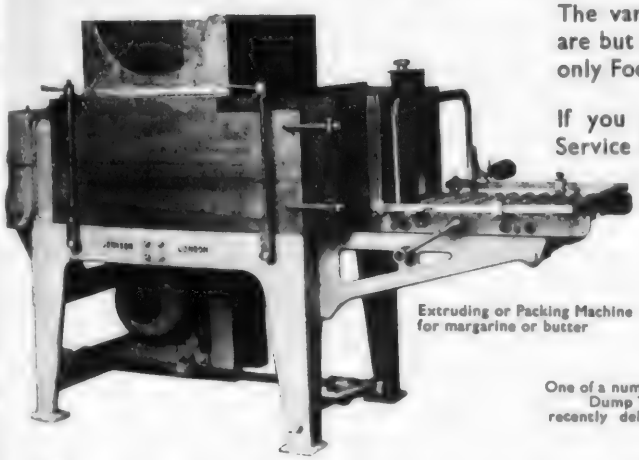

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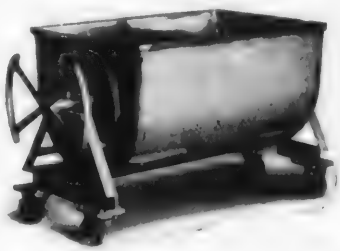

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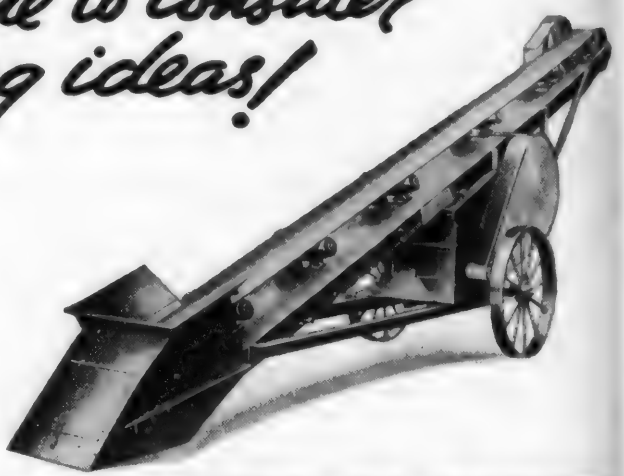

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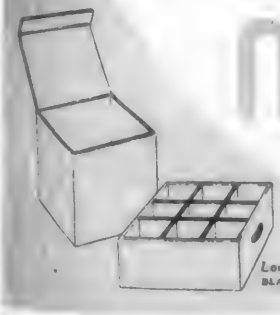

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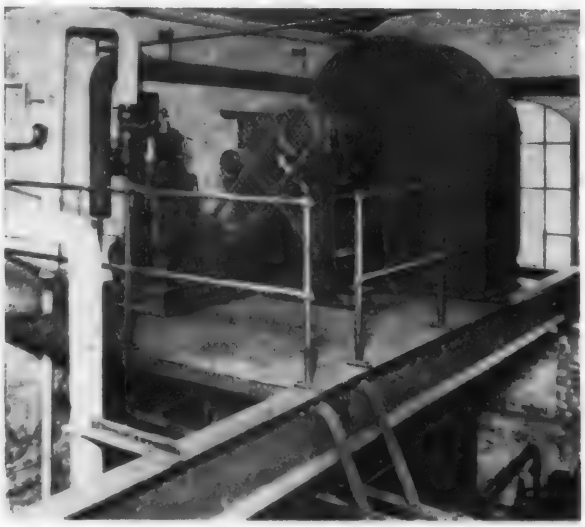

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Showing an Albro 16-head vacuum-operated filler for Worcester Sauce; constructed throughout in bright polished Stainless Steel.

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RUBBER ECONOMY

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Joint research is being carried out by the undermentioned manufacturers which it is hoped will shortly result in the production of satisfactory self-adhesive sealing tapes having no rubber content. When this stage is reached, it is hoped there will be adequate supplies of sealing tape available for reasonably essential purposes, but in the meantime as long as rubber must be used in the preparation of these tapes, it is essential that the strictest economy be exercised in their use.

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But the note, harsh and raw
Of the mating macaw
Through a filter like this
Holds the thrush's pure bliss . .
And is twice as melodious.

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Specialists in the removal of foreign matter.
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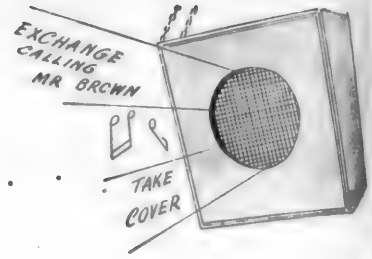

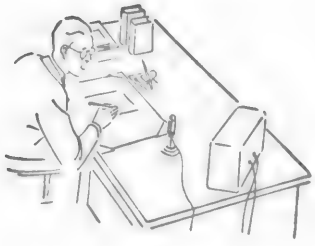

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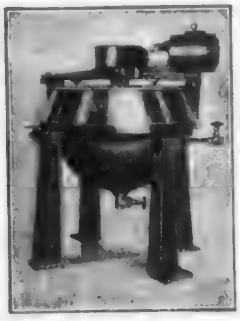

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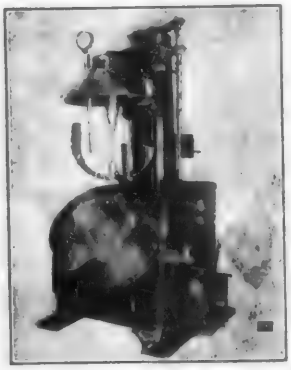
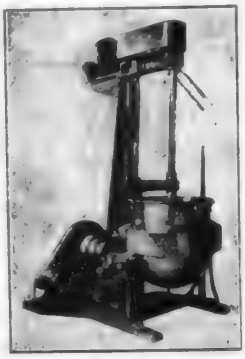
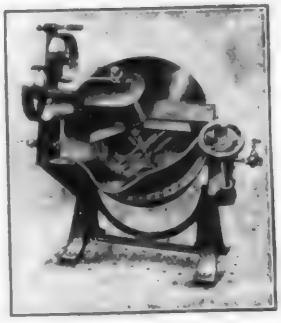
ALL TYPES IN ALL METALS







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Makers of GOOD MIXERS

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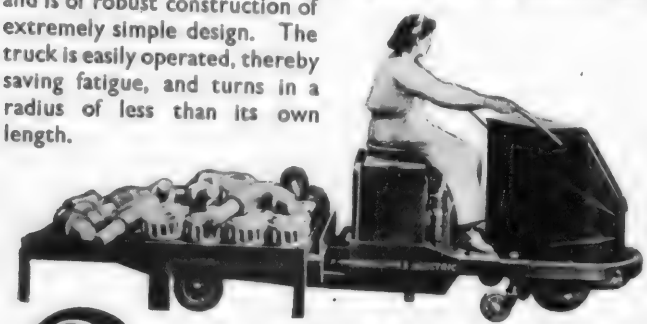
This new addition to the famous Ransomes range of Electric Industrial Trucks is a "one tonner." The truck illustrated is the T.E.2L with low elevating platform, 4' 10" x 3' 4" for use with stillages.

It is of the 3-wheeled type, with the drive on the front wheel, and is of robust construction of extremely simple design. The truck is easily operated, thereby saving fatigue, and turns in a radius of less than its own length.



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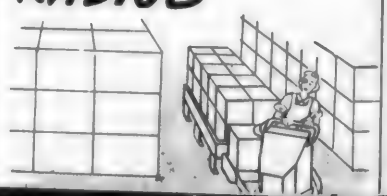

Ransomes ELECTRIC Industrial TRUCKS

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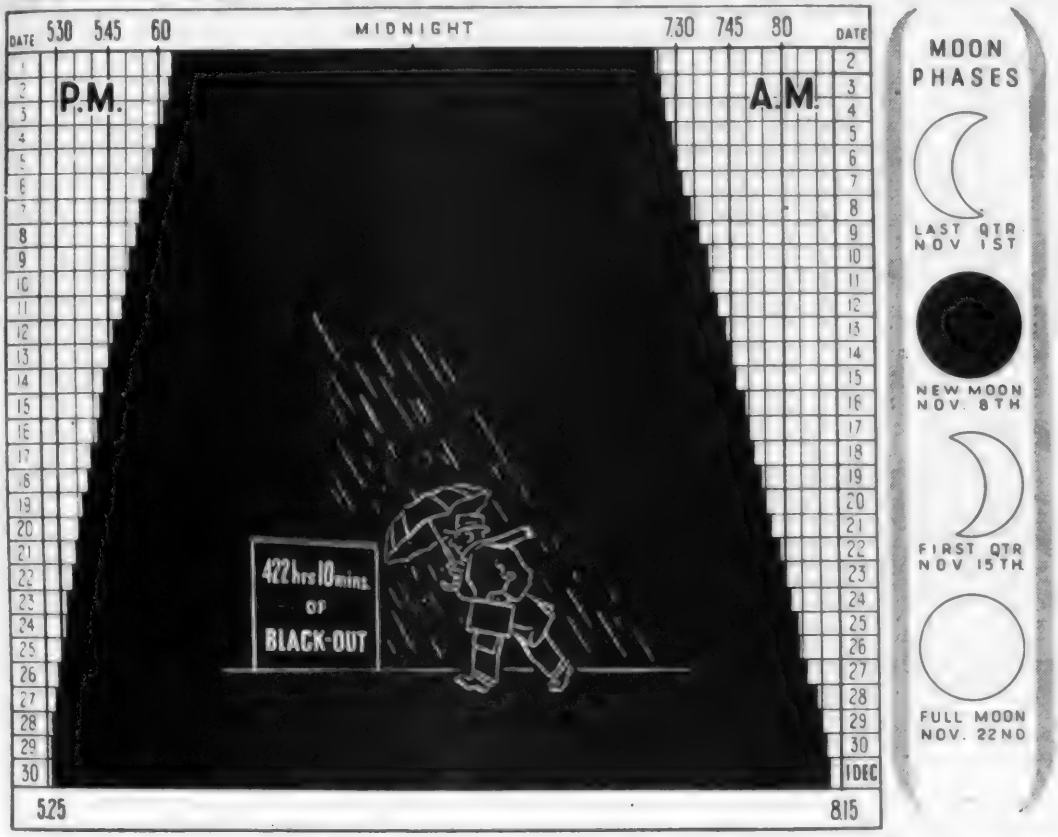
Will it be a hard winter?

BLACK-OUT CHART FOR NOVEMBER



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★ *Times shown are those for the London area.*

It cannot be forecast how much snow or frost, rain or fog will be our portion this winter. Whether it be a "hard" winter or not, black-out conditions in works and factories will still make hard going for the maintenance and increase of output. Make sure, then, that good lighting prevails everywhere—make sure by fitting Osram lamps that once again they may play their part in creating a bright, stimulating atmosphere for every kind of work.

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Ashex Concentrated Essences, for all flavouring purposes, in Liquid and Powdered types.

Liquid and Powdered Sweetener, for all manufacturing purposes.

Bulking and Filling Agents, for most purposes.

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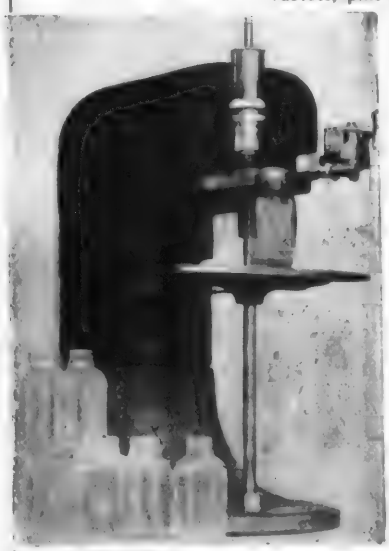
Output up to 1,000,000 per day.

One operator. 1/30 H.P. Motor.



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MACHINE for SCREWING & TIGHTENING

Caps on to bottles of any size or shape.

Output 25,000 per day.

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DOUBLE SEAMING MACHINE

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Output 50-100 per hour.

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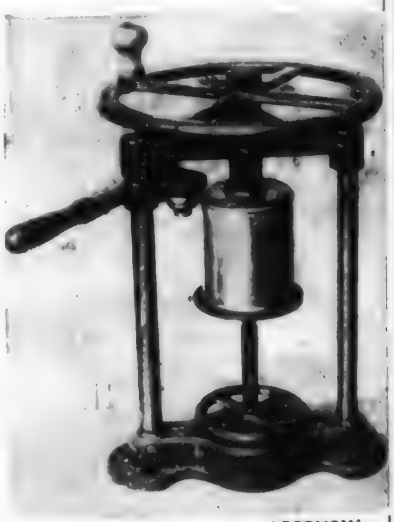

'ECONOM'

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Means Service

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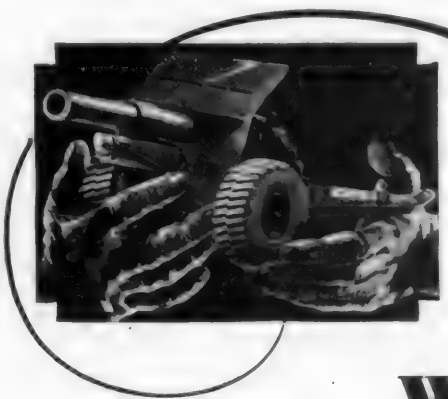

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You can help us to supply your requirements for essential war work by showing on your orders the appropriate Government authority to buy.

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AMPHORA BRAND — LAUTIER FILS LTD

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AT KEENLY COMPETITIVE PRICES

ALL OF THEM PURE MATERIALS—EASY TO MIX—INEXPENSIVE TO USE

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For Preservation of Purity!

Poppe Rubber Rings are the Perfect Seal

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Science stops mice meeting

Two or three mice on your premises may soon present you with the problem of dealing with thousands. The successful scientific methods employed by the British Ratin Company in the war against rats throughout the country can be used with equal success effectively to deal with this ever-growing menace.

The service offered by the British Ratin Company is the outcome of years of patient study of the whole problem of vermin infestation.

The British Ratin Company has no preparation for sale to the general public; it offers a service only.

Fill in the coupon and the Ratin Company's local surveyor will call and give you an estimate for dealing with your infestation.

The Ratin Service is available anywhere in Great Britain and Ireland.

The Service also deals effectively with beetles, cockroaches, and other insect pests.

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Please ask your Surveyor to call and explain how the Ratin Service (preparation not supplied) deals with rats, mice and insect pests

Name .....

Address .....

Date of appointment ..... *Time* .....

A well-known Confectioner writes:

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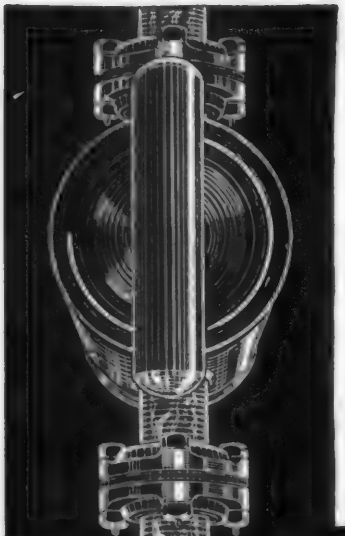

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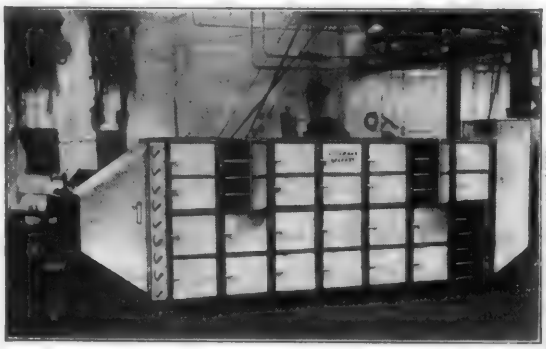

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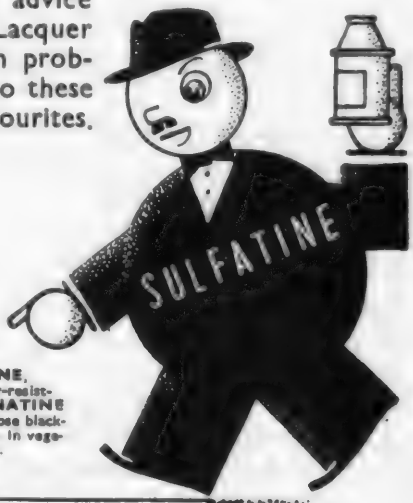

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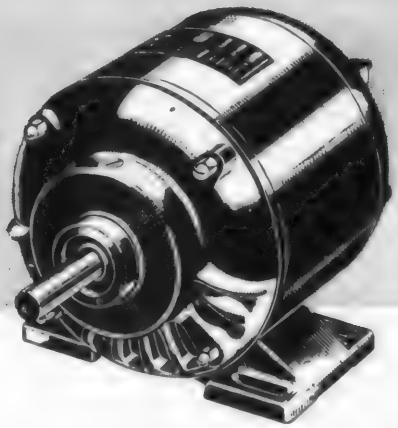

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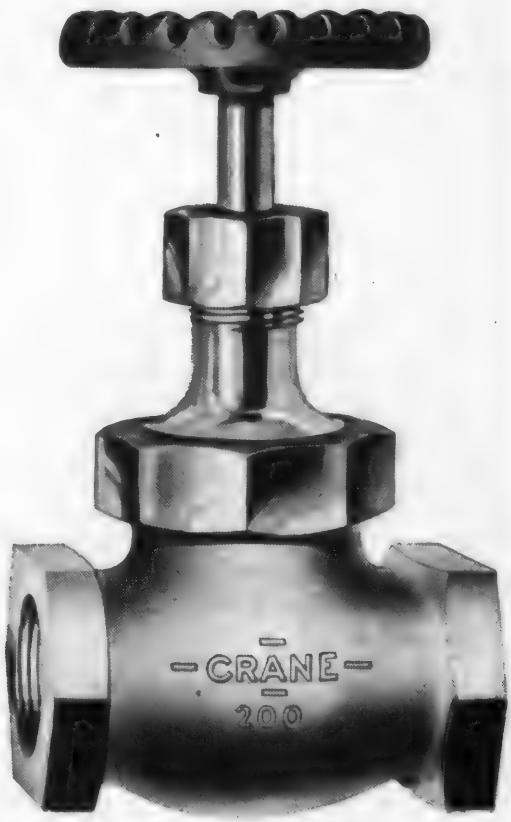

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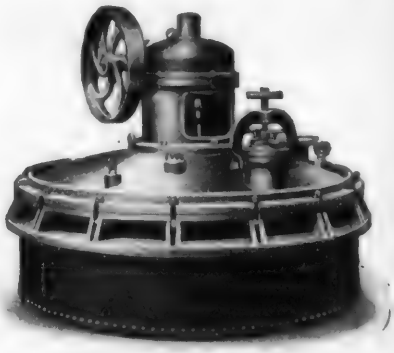

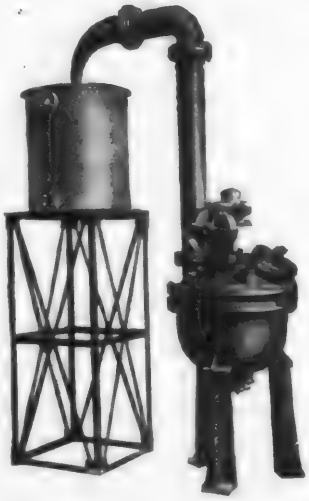

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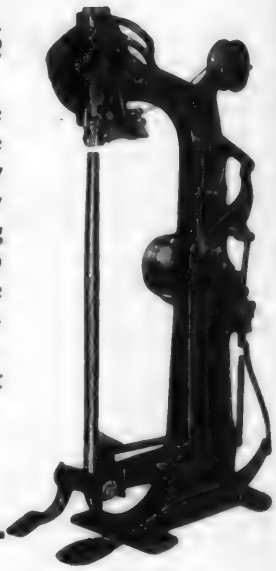

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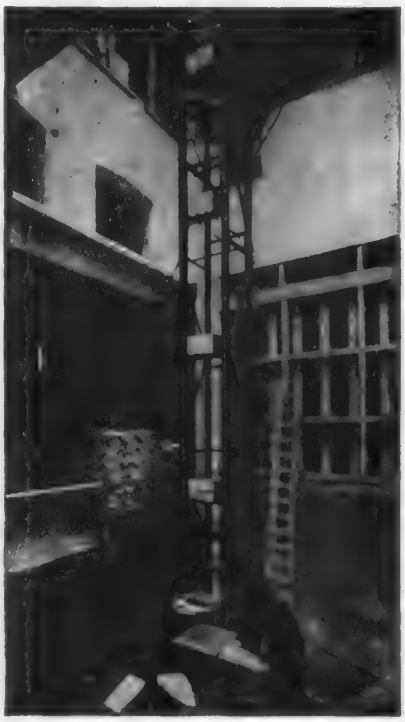

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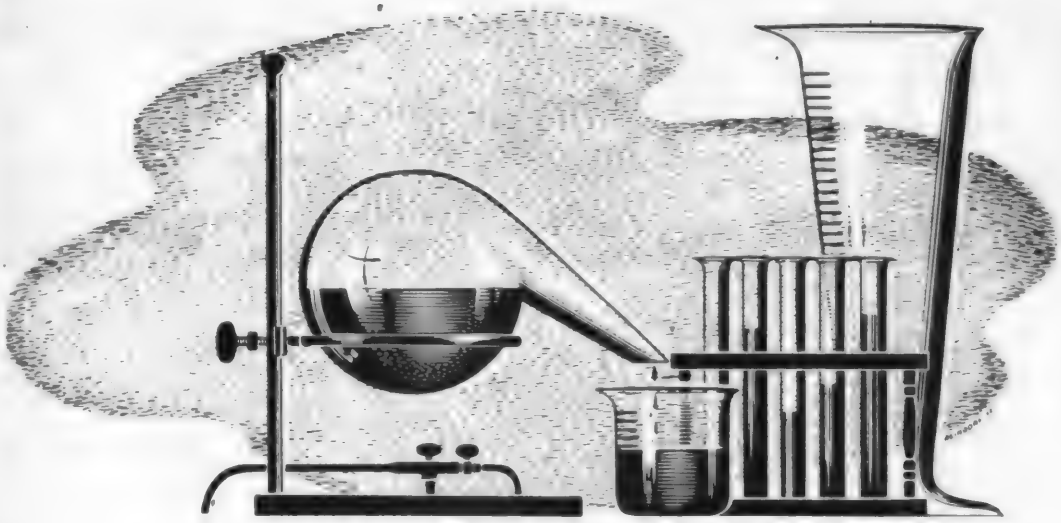

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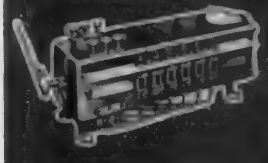

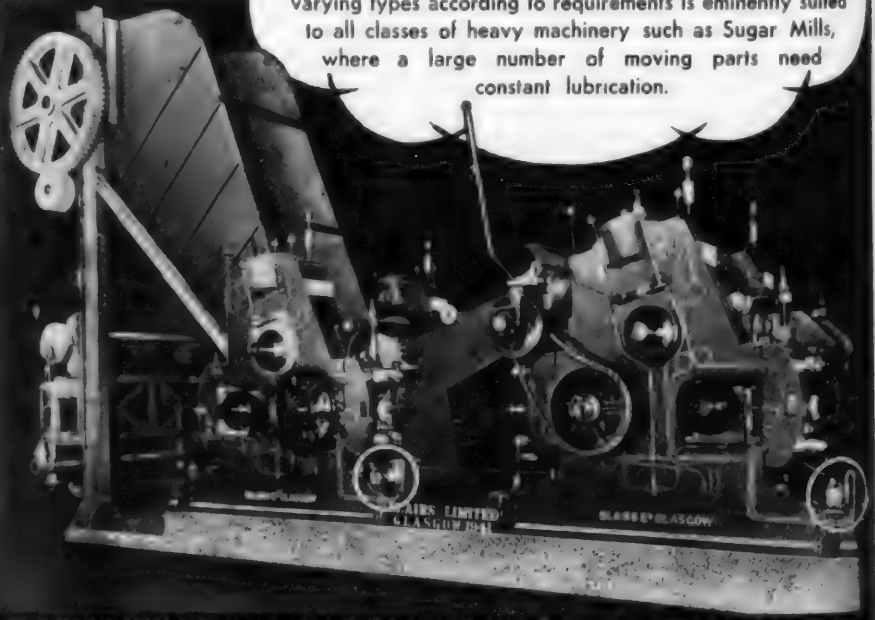

An illustration of one of the three Tecalemit "Brentford" Lubricators, Model BGR 66, with "flow indicators" fitted by Messrs. Blairs Ltd., Glasgow, to their Sugar Milling Plants shown herewith.

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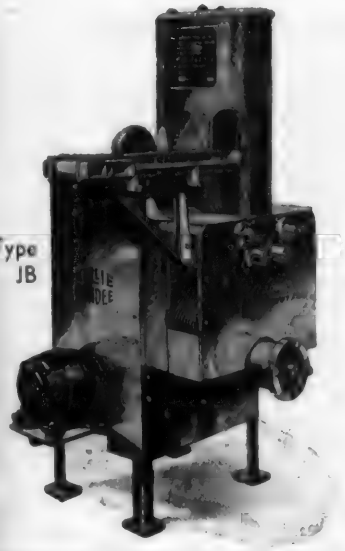

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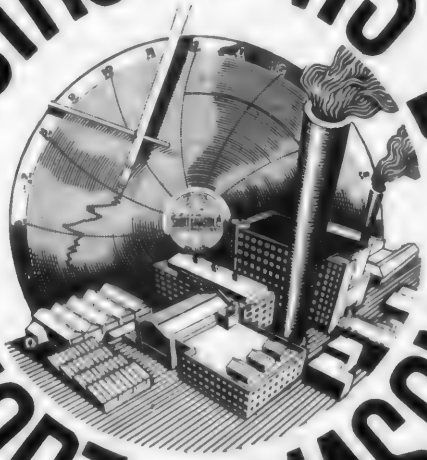

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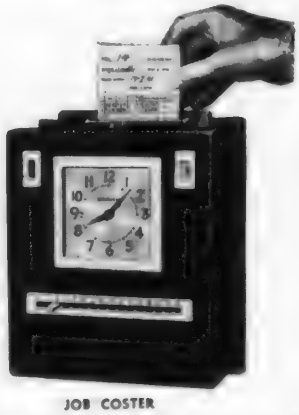

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Vol. XVII. No. 11. Published Monthly · November, 1942

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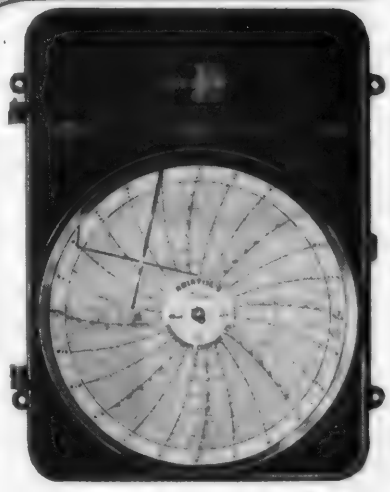

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FOOD MANUFACTURE

Vol. XVII, No. 11 November 1, 1942

Mr. Sidney Foster's Resignation

TO those who have followed closely recent events in the milk industry the resignation of Mr. Sidney Foster from his position as Director of Milk Supplies to the Ministry of Food created little surprise. About three months have elapsed since the Ministry made quite clear that the functions of the Milk Marketing Board were confined to milk production, and that distribution was the function of Lord Woolton's department. As Mr. Foster is also the General Manager of the Milk Marketing Board, many people expected his resignation from the Ministry months ago.

The peg on which his resignation has been hung is the milk price structure which the Ministry introduced on October 1. Milk producers have two main objections to this scheme:

(*a*) They have lost their level delivery premiums.
(*b*) They fear that the price structure will cause difficulty for producers when normal trading conditions are restored after the war.

Level delivery premiums have in the past been paid to about 12,000 producers out of a total of some 150,000. The sum involved was estimated at £400,000 annually. The Ministry has *not* suppressed these premiums. Buyers contend that under the Milk Supply Scheme every retailer is obliged to accept a level quantity whether he desires it or not, and that producers can no longer perform any service in return for a level delivery premium. No sound case to refute this argument has been placed before the Central Milk Distributive Committee, and buyers have therefore refused to pay any premium except for T.T. milk.

The post-war objection is that buyers are now allowed ¼d. a gallon for supplying churns and that retailers with large daily intakes enjoy wider "margins" than small retail dairymen. The Milk Marketing Board expects difficulty over these points when normal conditions are restored.

The resignation of Sir Robert Gordon-Finlayson, Director of Milk Distribution, is not connected with these matters. He was mainly responsible for the rationalisation of retail distribution, and that task is well advanced. The new head of the department is Mr. W. R. Harper, an ex-president of the National Dairymen's Association, but he will not be known as "Director".

Essential Work Order

A surprising development has taken place in the move to bring the manufacturing and distributive sections of the milk industry within the provisions of the Essential Work (General Provisions) Order. As announced in these notes last month, the personnel of the Milk Distributive Trade Board, to whom the task was entrusted, failed to reach agreement on terms and conditions of work in the service of firms scheduled under the Order. Only a small difference in the suggested scale of wages then prevented agreement from being reached. The two sides decided to resume the the negotiations, and ultimately the differences were settled. Employers' and workers' organisations have forwarded details of the agreement to the Minister of Food, who is expected to ask the Minister of Labour to bring these sections of the milk industry within the scope of the Order on the terms agreed.

Minimum weekly wages are prescribed for men employed by scheduled firms and also for roundswomen, other female workers engaged in distribution or processing, and for juniors.

Scheduling of firms under the Order will be voluntary. In the near future, therefore, some firms may be bound by the new rates while others continue to observe the Trade Board scale.

Natural v. Synthetic Vitamin C

That increase of cases of what may generally be called "furunculosis" was very marked during last winter and spring has been pointed out by Dr. G. L. Davies in a letter to the *B.M.J.*, September 19. With the arrival of summer and an abundance of natural vitamin C in the form of tomatoes and blackcurrants further outbreaks ceased. Dr. Davies ascribes the malady to a lack of *natural* vitamin C, "synthetic vitamin C having very little therapeutic effect. An increased permeability of the capillaries appears to be the result of this lack of natural vitamin C, and seems to show that the vitamin alone is not the whole story in such conditions". It may interest chemists to read Dr. Davies' conjecture that "it is possible, perhaps, that natural vitamin C has some principle loosely combined with it and acting as a sort of catalyst which has not yet been identified by chemists".

Food Poisoning at Maidenhead

A severe outbreak of food infection caused by the consumption of pressed pork occurred in August last at Maidenhead and district. The incriminated food had been prepared from the carcases of three young pigs, which were emergency-slaughtered on account of showing signs of illness. Some 300 persons were affected, and about 60 of the cases were investigated by the Public Health Authorities. One case terminated fatally.

The pigs, after slaughter, were examined by the meat inspector and found to be poorly nourished, their feet affected with sores, and in one case the tail was also affected, and appeared to have been gnawed by rats.

After removal of the affected parts the carcases were passed for human consumption, graded for manufacture into pork products, and allocated to a Maidenhead butcher.

During the outbreak specimens of the fæces from forty cases were bacteriologically examined, and in six the germ corresponded with the one found in a fragment of the pressed pork.

A post-mortem was performed on the fatal case. Bacteriological investigations on the intestinal contents, the heart blood, liver and spleen, showed heavy growth of an organism (*B. aertrycke*) associated with food poisoning.

The minutes of the Health Committee, dated September 14, presented at a meeting of the Town Council, record that "extensive bacteriological examinations were being made, and these would probably take some time to complete".

The outbreak might well have been more serious than it was, and the public will doubtless be interested in a full report of the results of the investigation now in progress and a reasonable assurance that all possible steps will be taken to avoid a recurrence.

Food Infection by Flies

That the common house fly can act as a carrier of micro-organisms and as polluters of food products has been long recognised, and some recent experiments carried out by Morris, Ostrolenk, and Henry Welch (*Food Research*, May-June, 1942) emphasise the dangers from this disgusting insect.

Among several sets of experiments described, to establish actual pollution of food by fly contact, portions of sterilised pecan nuts were exposed to approximately 150 flies for varying periods of time. These flies were obtained from a larger population which for three generations had been caged with mice infected with *Salmonella enteritidis*. At the end of a 15-minute interval 900 bacteria had been deposited per gram of pecans. In 45 minutes the bacterial count had increased to 560,000 per gram, and there was a gradual increase in the number of bacteria until the fifth hour, when counts of 3,500,000 per gram of pecans were obtained. *Salmonella enteritidis* was isolated from the pecans in all the intervals of exposure.

It is of particular significance that throughout the six periods of exposure (15 minutes to 5 hours) not more than 12 flies were seen to be feeding on the pecan nuts at any one time, and on the average only 8 flies were present during 11 counts made at random on each of the dishes of exposed pecans. These flies, which were carriers of *Salmonella enteritidis*, deposited this organism on the pecan nuts in every period of exposure.

The experiments tend to show that even small numbers of flies in a food establishment constitute a filth menace, the seriousness of which may be determined by careful evaluation of surrounding conditions.

More Food Substitutes

Writing of Germany as "a land of substitutes where dainty dishes from chemicals are here, there and everywhere", a correspondent assures us that while such food products are shrouded in mystery they are really tasty!

By means of secret formulæ and processes the smoke from coal, in Dr. Emil Fischer's hands, is made to produce a proteid containing all the elements of a beefsteak.

Sugar from iron rust (which our correspondent says is plentiful!) is the latest Nazi idea of eking out dwindling sugar supplies in occupied Europe. Professor Osterhout exposes the "metallic scales" to the prismatic rays of the sun through water. Formaldehyde is produced from which sugar in certain forms may be made.

Artificial meat from brewery or distilling refuse is the idea of another Nazi expert. By acid and lime treatment an evaporated pasty product is obtained which tastes like real butcher's meat and is two or three times greater in food value than the genuine product.

In a bakery using prepared sawdust instead of flour, it is said that 20,000 loaves are being turned out daily as an experiment.

Farmers may be interested to know that "with some Nazi experts a popular idea prevails that certain foodstuffs of the future will be drawn from the atmosphere instead of from the land. This will be accomplished with the aid of ultra-violet rays. Their ploughing, sowing and reaping may be dispensed with, and the agriculturalists who now prepare the land will be employed in garnering the invisible air forces for food production.

Our correspondent, with a certain *naïveté*, qualifies the foregoing notes by saying that "whether the scientist with his numerous test tubes and books of formulæ ever succeeds in doing all he claims it is impossible to say"!

Animal Health Service

There are over 8,500,000 cattle, over 25,500,000 sheep, 4,500,000 swine, 70,000,000 poultry, 1,000,000 horses, 3,000,000 dogs, and multitudinous cats in the country, stated Dr. W. R. Wooldridge in his presidential address to the National Veterinary Medical Association recently when advocating a national animal health service. The extent of these statistics clearly indicates the vital importance of animals in the life of the nation, especially in wartime. The most striking fact about our animals is undoubtedly the high number of instances of disease among them.

A bold co-ordinated animal health service would result in a considerable reduction in disease, and a material lessening of the monetary loss involved, which could not be assessed at less than £50,000,000 annually. The task of the veterinary profession could be nothing less than the organisation of an efficient service to minister to the welfare of all animals, and to secure an improvement in the quantity, quality and safety of human foodstuff of animal origin.

A service designed to this end could not be divorced from the service devoted to maintaining the health of animals.

An organisation necessary for a nationally co-ordinated service of animal health was to be based upon the reasonable supply, in almost every part of the country, of veterinary assistance for all animals. There must also be a number of specialist services comprising veterinary surgeons, who had devoted further studies to some particular branch of veterinary science.

Soured Sheep's Milk

In view of the renewed interest in the sheep as a source of dairy produce, it may be of interest to note some data for the fermented Albanian beverage known as "kos". The process of manufacture, as reported by T. Castelli, consists in rapidly bringing the whole milk to the boil, inoculating it at 45° C. with old kos culture, and finally leaving it to ripen at 37° C. for 24 hours. A typical product contains 0·45 per cent. alcohol and 0·81 per cent. acid, calculated as lactic.

Castelli has examined the organisms present in kos culture (*Annali di Microbiologia*, August, 1940), and finds that the forms responsible for fermentation are *Lactobacillus bulgaricus*, *Streptococcus thermophilus*, *S. lactis*, and *Torulopsis, Holmü* var. *Kos*. Lactose plays a fundamental part in the process during which the fats and proteins suffer little change. The same investigator examined the possibility of preparing a "kos" from cow's milk and obtained promising results, although the alcohol and acid contents in this case were somewhat lower.

To Chew or Not to Chew

Every epoch is strewn with the remains of the beliefs of previous ones. Many of these beliefs survive and the newer knowledge kills others.

The late William Ewart Gladstone, in the intervals of the practice of high diplomacy, philosophy and literature, promulgated a dietetic rule which had a considerable vogue for a long time. It was that each mouthful of food should be chewed eighteen (or was it twenty-four or some other number?) times. And now we gather from Dr. Frederick F. Tisdale, of Toronto, that the mere act of chewing foods causes the destruction of half their vitamin C. Pyke and also Lampitt, Baker and Parkinson recently published details of the losses of the vitamin incurred by grating and chopping, which depend on the type of chopper used, but they omitted to say anything about the chewing. It seems as if instead of chewing our food we should swallow it whole.

Poems and Potatoes

Suspicious even more than of his next-door neighbour (although we are told that the war has changed all that) is the Englishman of unaccustomed foods or even familiar foods in new guises. To some extent he is justified if he has experienced, as we have in different countries, the horrors of dishes of unborn calf of an incredible rubberiness; of raw sea urchins; of roast wild cat; of vegetable soup highly acidified with citric acid, and so on. But during such gastronomical adventures there were delightful discoveries such as corn-on-the-cob, the avocado pear, and, among many others, a potato dish which, although hardly meriting Lord Woolton's hyperhole in referring recently to certain potato dishes as "poems".

With inimitable showmanship and Lord Woolton as chief showman was the grand final of a potato cooking competition carried out at the Ministry of Food, arranged by the British Central European Chamber of Commerce, in the presence of diplomats and members of the resident national Governments.

First prize went to Greece with potato *Musaka* and potato *Kepte*. Poland was second with *Kluski*, Czecho Slovakia with *Bramborak*, and the Yugoslav and Viennese teams tied for the remaining honours. All these names leave us guessing, but *gourmets* will shortly know the secret of their composition from the B.B.C. through their Kitchen Front programme.

Coming events cast their shadows before, and we have been warned that potatoes may form a greater part of our diet than they do now. Perhaps *Kluski*, etc., thanks to our Allies, may constitute the answer to a wistful desire for a happy issue from the interminable "boiled, mashed or fried".

Recent Developments of the Resazurin Test

Developments have been so fast in this country during the last year that few people can be familiar with the advances that have been made. This article is an attempt to summarise the present position, and deals principally with the synthesis, purification, properties and standardisation of the dye, its behaviour in milk, the preparation of the solution, the use of the comparator, and the various modifications of the test.

JOHN G. DAVIS, D.Sc., Ph.D., F.I.C.
(The National Institute for Research in Dairying)

SIX MONTHS ago we were entirely dependent upon imported supplies of resazurin and had practically no first-hand knowledge of the chemistry of the dye. To-day we can prepare unlimited quantities of dye of greater purity than the imported product.

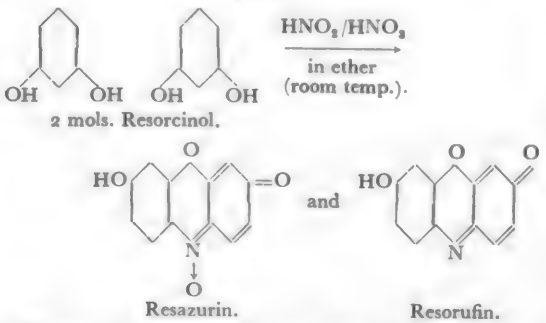
Synthesis

As a result of our suggesting resazurin as a subject of research to the Advisory Research Committee of the Chemical Society, Dr. W. Baker and Mr. W. G. Leeds, of the Dyson Perrin Laboratory at Oxford, tackled the problem, and in a remarkably short time they had worked out a method of synthesis that yielded a somewhat purer product than the best imported material. The Oxford synthesis involved the oxidation of resorcinol in cold, dilute ethereal solution by nitric acid containing nitrous acid[1, 2] (Fig. 1). About the same time Dr. W. F. Short and Mr. P. Oxley were also working on the problem at Messrs. Boots. These workers also evolved a satisfactory synthesis using a different method—viz., the oxidation of an equimolecular mixture of resorcinol and nitroso-resorcinol by manganese dioxide and sulphuric acid in aqueous acetone[2, 3] (Fig. 2). Finally, Messrs. Thornley and Hilton have successfully synthesised resazurin at Bengers, Ltd., by the Oxford method.[4]

Purification

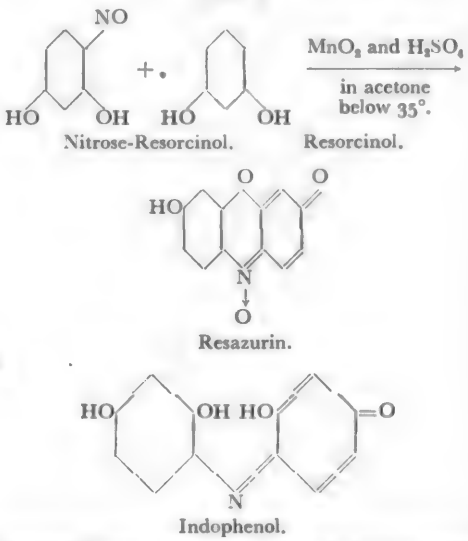
All workers appear to use the same method for the purification of the dye—namely, repeated precipitation

FIG. 1



Resazurin is formed only when ether is used as solvent; the presence of nitrous acid is essential and the reaction is complex.

FIG. 2



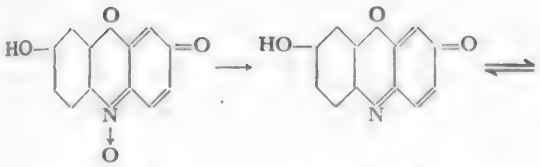
Very little resorufin is formed and the indophenol does not appear to be an intermediate in the reaction.[3]

of the sodium salt from strong sodium carbonate solution, in which sodium resazurate is sparingly, and sodium resorufate readily, soluble. The imported material appears to have undergone two such precipitations and consists of sodium resazurate equivalent to 60 per cent. resazurin, traces of sodium resorufate and the residue of sodium carbonate. The English products contain the equivalent of 70 to 90 per cent. resazurin. The resorufin content can be minimised by repeated precipitation, and the sodium carbonate by careful drainage.

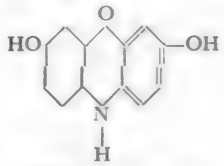
Properties

Resazurin ($C_{12}H_7NO_4$) is an oxazone which easily loses its oxazone oxygen atom to be reduced to the corresponding oxazine, *resorufin* ($C_{12}H_7NO_3$). This change is not electronically reversible and so cannot be related to a definite Eo value. The oxazine is reversibly reduced, however, to dihydroresorufin.

The change resorufin $\rightleftharpoons$ dihydroresorufin occurs over a range of Eh from +0·150 to −0·050 v. in milk[5] and has an Eo of about −0·020 v. at *p*H 6·9.[6]



Resazurin. Resorufin.



Dihydroresorufin.

In addition, resazurin is a *p*H indicator, being blue above *p*H 6·8 and red below 5·3. Resorufin is red above 6·4 and yellow-orange below 4·8. As milk which is acid enough to affect resazurin as a *p*H indicator is markedly sour and therefore strongly reducing, this *p*H effect is of no significance in the resazurin test.

Resazurin itself is insoluble in water, but sodium resazurate is about 1 per cent. soluble; resorufin is more soluble, and sodium resorufate about 5 per cent. soluble.

Sodium resazurate in the pure state is reasonably stable, but in the presence of hydrogen donators such as milk, lactose, etc., is rapidly reduced when activated by sunlight.

Absorption

Dr. Short has sent me the following results obtained by Drs. Gillam and Elvridge:

	Wave-length. $m\mu$.	$E_{1\%}$. 1 *cm.*
Resazurin at *p*H 4	500	530
,, at *p*H 8	235-250	1,000
	380	490
	605	1,964
Resorufin at *p*H 8	245-260	95
	575	585

Chromatographic Adsorption

Chromatographic adsorption on calcium carbonate using benzene-methyl alcoholic solution has been found the best method by Short and Oxley, and they have been able to separate resorufin from resazurin in this way. The indophenol gives a purple layer in the first zone, resazurin a deep blue layer in the second, and resorufin a pink layer in the third. Nitroso-resorcinol is not adsorbed and passes through the column when the chromatogram is developed.[3]

Assay of Resorufin

Attempts have been made to assay resorufin by various methods, but so far no simple reliable method

TABLE 1

Ten samples of milk were tested by 5 samples of resazurin as follows:

A. Eastman's (0·05 per cent. stock).
B. Bengers (tablets).
C. Baker's (pure Na salt, 0·042 per cent. stock).
D. Boots (tablets).
E. Boots (0·035 per cent. stock).

RESAZURIN AT 37° C.

Milk Sample.	10 *Minutes.*					30 *Minutes.*					1 *Hour.*					2 *Hours.*				
	A.	B.	C.	D.	E.	A.	B.	C.	D.	E.	A.	B.	C.	D.	E.	A.	B.	C.	D.	E.
1 ..	6	6	6	6	6	5+	5+	5+	5½	5+	4	4½	4+	4	4	1½	2	2	2	1−
2 ..	5+	5½	6−	6−	6	5	4	4	4+	4½	2	2	2	2	2	0	0	0	0	0
3 ..	3½	3½	4	4	4	2	2	2	2+	2	0	0	0	0	0					
4 ..	5½	6	6−	6	6	5+	5	5½	5½	5	3	3½	3½	3½	3½	½	½	½	½	½
5 ..	6	6	6	6	6	5½	5½	5−	5½	5	3−	3+	3+	3	3	½	½	½	½	½
6 ..	0	0	0	0	0															
7 ..	5	5	5	5	5	3	3	3	3	3	½	½	½	½	0	0	0	0	0	0
8 ..	3	3	2½	2½	3	0	0	0	0	0										
9 ..	0	0	0	0	0															
10 ..	2	2	2	2	2	0	0	0	0	0										

RESAZURIN AT 18° C.

Milk Sample.	30 *Minutes.*					1½ *Hours.*					3 *Hours*					6 *Hours.*				
	A.	B.	C.	D.	E.	A.	B.	C.	D.	E.	A.	B.	C.	D.	E.	A.	B.	C.	D.	E.
1 ..	6	6	6	6+	6	5	5	5	5	5	3½	3½	3½	3½	4	2	2	2	2	2−
2 ..	5+	5+	5	5	5	4−	4	3½	4	4½	1½	1½	2	2−	1½	0	0	0	0	0
3 ..	3+	3	3+	3	3	½	½	½	½	½	0	0	0	0	0	0	0	0	0	0
4 ..	6−	6	6−	6	6	4½	5−	4½	5−	4½	2	2	2	2	2	½	½	½	½	½
5 ..	6	6	6	6+	6+	4	4½	4½	5	4	3−	3	3	3	3½	½	½	½	½	½
6 ..	0	0	0	0	0															
7 ..	5−	5−	5−	5	5	3	3	3	3	3	1	½	1−	½	½	0	0	0	0	0
8 ..	3	3	3	3−	3	½	½	½	½	½	0	0	0	0	0					
9 ..	0	0	0	0	0															
10 ..	½	½	½	½	½	0	0	0	0	0										

TABLE 2

COMPOSITIONAL ANALYSIS OF DIFFERENT SAMPLES OF RESAZURIN.
(Weiler.)

Sample.	*Carbon.*	*Hydrogen.*	*Nitrogen.*	*Oxygen.*	*Ash.*	*Moisture.*
A. Eastman BDH ..	45·2	2·3	4·95	9·97	26·8	10·79
B. ,, ,, ..	45·3	2·3	5·08	9·35	26·9	11·06
C. ,, ,, ..	45·3	2·3	4·74	8·57	27·8	11·22
D. Nat. Aniline ..	44·7	2·4	4·92	10·56	27·9	9·45
E. — ..	53·6	2·8	5·72	6·92	20·9	10·06

CALCULATED ON THE ASH- AND MOISTURE-FREE SUBSTANCES.

	C.	*H.*	*N.*	*O.*
A.	61·60	3·14	6·52	28·74
B.	62·00	3·16	7·04	27·80
C.	62·80	3·33	7·07	26·80
D.	61·95	3·38	7·63	27·04
E.	67·06	3·12	5·99	23·83
Theoretical ..	62·9	3·06	6·11	28·0

has been worked out. Differential solubilities, absorption spectra and chromotographic analysis all fail to give clear-cut differences between resazurin and resorufin.

In practice, however, the tintometer disc and chromatographic analysis will detect those quantities of resorufin which are large enough to interfere with the test. Small quantities—*e.g.*, up to 5 per cent.—can safely be ignored. One particularly bad sample started at 4½ on the disc, and chromatographic analysis indicated about 20 per cent. resorufin.

We have tested many preparations, powder and tablet, and, with the exception of the bad specimen mentioned above, all have agreed within the experimental error of ±½ disc reading. (See Table 1.)

It is hoped to develop potentiometric methods for the assay both of resazurin and resorufin.

Data on the analytical aspect are given in Table 2.

Standardisation

Small variations in concentration—*e.g.*, ±10 per cent.—do not affect the test, and all preparations of reasonable purity give similar results in all milks tested. The presence of appreciable amounts of resorufin leads to errors, and bad preparations containing tarry matter are unsuitable. Resazurin should never be sold in dilute solution. Approved tablets and powder may be used, and laboratories may use a stock 0·05 per cent. solution prepared under supervision, which is diluted before use.

The following chemical standards have been tentatively adopted for resazurin powder :

1. The material shall contain sodium resazurate equivalent to 60 ±3 per cent. free resazurin.

2. No other dye (apart from traces of resorufin) shall be present.

3. The residue shall consist only of sodium carbonate and/or sodium acetate and moisture.

4. A 0·05 per cent. solution in dilute NH_4OH shall give a colourless water-clear solution on reduction with H_2S.

5. The material shall give in fresh normal mixed Shorthorn milk of 3 to 4 per cent. fat in a concentration of 1 in 200,000 a tintometer disc reading of not less than 6.

Bacteriological standards are as follows :

6. One ml. of a 0·005 per cent. solution in sterile ringer shall give a colony count of not more than 10 when plated in milk agar and incubated for 2 days at 37° C.

7. The material shall behave in all types of milk similarly to the standard materials maintained at the National Institute for Research in Dairying. A difference of ±½ disc reading is the maximum permissible.

Resazurin Tablets

8. Tablets shall be prepared from the material described above and lactose or other approved diluent only.

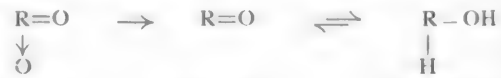
9. When dissolved according to instructions, the solution shall contain 0·005±0·0005 per cent. of " resazurin " as defined above.

10. The solution so prepared shall conform to the bacteriological condition described (Nos. 6 and 7 above).

Detailed methods for the examination of powder and tablets will be issued shortly.

Behaviour in Milk

As far as we know, only two reactions are of interest to us—



Resazurin. Resorufin. Dihydroresorufin.

These two changes are different in their characteristics, for while both require 2 atoms of hydrogen for reduction, the first is controlled chiefly by chemical specificity—*i.e.*, the ability of a reducing system to react with the oxazone oxygen atom—and the second chiefly by the Eh of the solution. The Eo is somewhat lower than that of methylene blue (about 30 mv. difference), and correspondingly resazurin (or resorufin) requires somewhat longer to reduce than methylene blue. This is partly due to the lower Eo and partly due to what corresponds to the " poising effect " of the first stage of reduction. Dihydroresorufin is very easily oxidised, and for this reason *tubes should always be examined carefully before inversion when recording results.* A pink band down to 1 cm. or so should always be ignored if the underneath milk is white.

It is not to be expected that a close relationship will

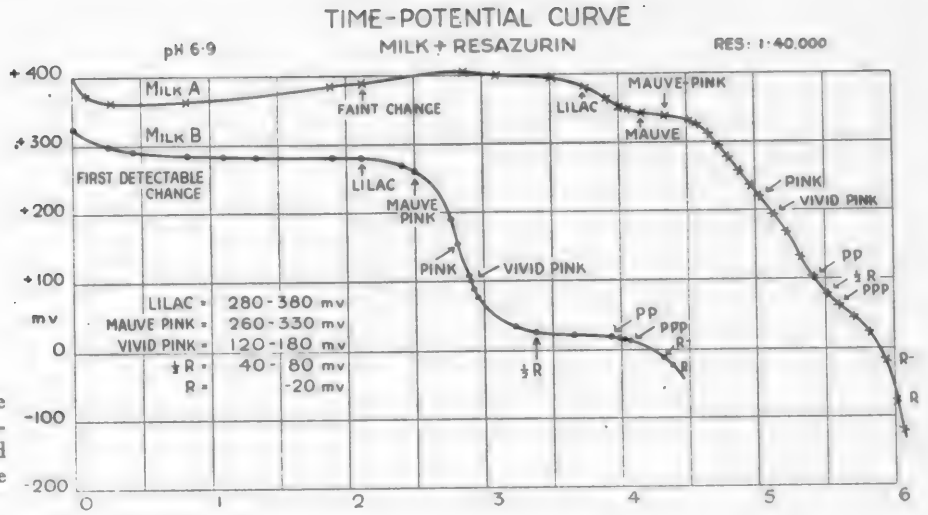


FIG. 3.

Typical Eh-time curves of milk containing resazurin and the colours of the dye.

occur between the Eh of the milk and the degree of reduction of the dye. The two predominant reasons are that the Eh-time curves of milks vary considerably, and, of course, the first stage is non-reversible and therefore not controlled or necessarily related to the Eh of the milk.

Typical Eh-time curves of milk containing resazurin and the colours of the dye are shown in Fig. 3.

It is evident, therefore, that bacteria, cells and reducing systems will affect resazurin (*a*) by their ability to remove the oxazone oxygen and (*b*) by their power of reducing the Eh of the milk. The reducing action is therefore a mixed one. These facts, and our general ignorance of what happens to resazurin in milk, have been raised by some workers as objections to the resazurin test. The validity of the test does not depend on theory, however, but on practical experience and comparison with other tests. We are still ignorant, for instance, of what happens exactly to methylene blue in milk, but this has not prevented the methylene blue from being an extremely useful test.

Two Distinct Actions Involved

With resazurin two distinct reactions are involved, and these normally run consecutively—viz., first, the irreversible reduction of resazurin to resorufin, corresponding to disc 6 falling to disc 1 on the comparator, and, secondly, the reversible reduction of resorufin to dihydroresorufin, corresponding to disc 1 falling to disc 0. This is illustrated in Table 3, from which it may be seen that each disc number corresponds to about a 20 per cent. change of the resazurin to resorufin. If the milk has a flora which holds it at a high Eh—*e.g.*, above +0·2 v—until the final swift drop, we may safely assume that all the resazurin is reduced before the resorufin is further reduced. In this case we get a full value for disc 1, and the milk may "hang" at this disc number before the final change to disc 0. If, however, the flora is such that the Eh falls steadily towards an Eh of 0, part of the resorufin is reduced before all the resazurin is changed to resorufin. This will result in failure to obtain a full pink corresponding to disc 1, the readings appearing to go from about 1½ to 1— (pale pink) or ½ (mottled pink-white) without passing through 1. This last point is clearly illustrated by what happens when resazurin is added to a very dirty milk at Eh of below 0. A peculiar mauve colour is obtained which rapidly goes pinkish and then white. It is impossible to match the colours accurately in this case, but as the disc reading is 0 well before 10 minutes, this point does not affect the accuracy of the test.

Dye Test not a Reliable Measure of Eh

Finally, it should be remembered that a dye test is not a reliable measure of Eh in milk. As a convenient

(*Continued on page 324*)

TABLE 3

(1-HOUR READING AT MODERATE ATMOSPHERIC TEMPERATURES.)

	Disc.		*Per Cent.*		
Bacterial Quality.	*Colour.*	*Reading.*	*Resazurin.*	*Resorufin.*	*Dihydro-resorufin*
Excellent	Blue	6	100	0	0
Very good	Lilac	5	80	20	0
Good	Mauve	4	60	40	0
Fair	Pink-purple	3	40	60	0
Poor	Purple-pink	2	20	80	0
Bad	Pink	1	0	(100)	(0)
Very bad	Colourless	0	0	0	100

The Oxidation of Starch

Methods of oxidation of starch by acid media, description of which began in the first instalment of this article in the September issue, are also discussed below, together with oxidation in alkaline media. Next month the survey will be completed by a brief account of methods of oxidation in neutral media and by a comprehensive list of references.

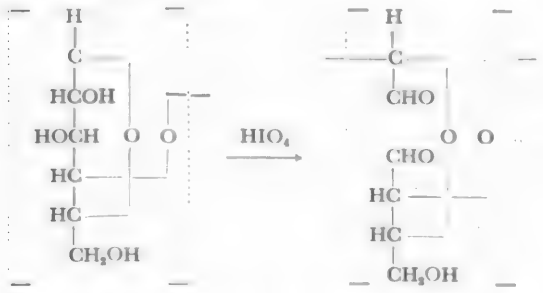
J. A. RADLEY, M.Sc., F.I.C.

Oxidation by Oxy-halogen Acids

Bräutigam[18] found that hydrolysis of starch to glucose preceded oxidation by hypochlorous acid, oxalic acid and carbon dioxide being produced. Craik,[32] on the basis of experiments with β-glucosan and disaccharides, postulated an addition of the hypochlorous acid to the ring or bridge oxygen atoms. Jambuserwala and Kanitkar[126] used 0·25, 1, 2 and 3% acidified hypochlorite on corn, wheat, sago and farina starches. They measured the R_{cu} reducing value (mg. Cu per gram of starch), viscosity, adhesive value and several other properties. With an increasing amount of oxidant the R_{cu} curves showed a slight decrease, then a rapid increase, along a straight line. The carboxyl content of each starch gradually increased during oxidation; the viscosity and adhesive value showed a sudden initial drop to a low value with only a small amount of oxidant. Thereafter the decrease of these last two properties was very slight upon further oxidation. Seck[205] patented the oxidation by hypochlorous acid.

Using chloric acid Schmerber[201] prepared a soluble starch, and Haake and Haake[90] as well as Mirow[154] covered the process in patents.

Most interesting results have been obtained by the action of periodic acid on starch which are of great academic interest and may be given briefly here. According to Jackson and Hudson[123] periodic acid reacted quantitatively with corn starch and oxidised the glycol grouping of the non-terminal glucose units to a dialdehyde structure. One mole of oxidant reacted per $C_6H_{10}O_5$ unit to split each anhydrohexose unit between the second and third carbon atoms into a two- and a four-carbon fragment. Hydrolysis of the oxidised starch would be expected to yield glyoxal from the two-carbon fragment and *d*-erythrose from the four-carbon fragment:



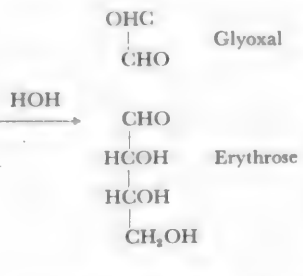
After hydrolysis Jackson and Hudson observed that the rotation was near the $[a]_D$ of −14·5° reported for *d*-erythrose, and Caldwell and Hixon[26] later isolated the glyoxal.

This reaction, Malaprade's reaction,[150] was employed by Caldwell and Hixon to determine the molecular size of the dextrines, and from their results they concluded that starch has a much greater chain-length than 25 to 30 units proposed by Haworth *et al.*[113] Jackson and Hudson[124] later isolated glyoxal from the hydrolysis products of oxidised starch, and identified *d*-erythrose. They stated that the presence of other types of units in the oxidised starch in minor quantities was not excluded, and indeed later a methyl acetal of an aldehyde or ketone was separated[84] from the hydrolysate of oxidised starch in methyl alcoholic hydrogen chloride. Corn, wheat, potato, arrowroot and soluble potato starches all yielded the same product.

Oxidation by other Per-Compounds

Samec[195, 196] included sodium perborate and ammonium persulphate among the oxidising reagents he used on starch. Neither of these reagents appeared to give extensively oxidised products and, in general, they both gave less modification than the other five oxidants, excluding air, which Samec used. Nakamura[160] confirmed these results, and the above two compounds have been used to produce slight physical modification of starch granules. A number of patents covering the use of persulphates and perborates have been taken out, most of which are of interest to the textile trade [29, 62, 63, 70, 71, 79, 99, 104, 114, 116, 120, 133, 140, 206, 211, 217-9].

The usual practice with perborate is to add about 1% to the air-dry starch. On cooking the starch the oxidation takes place, and it should be noted that the residual borax has a definite effect upon the starch solution, making it more adhesive. If required to thin a paste already made the perborate can be added in solution, or sifted on to the paste during thorough agitation, and the whole reheated to complete the reaction. Both perborate and ammonium persulphate have been employed to solubilise starch on fabrics and so permit its removal, and the latter is very efficient in this respect. The use of starch thinned with perborate for use in textile printing thickeners has been covered by patent.[203]



Oxidation by Oxides in Acid Solution

Döbereiner[42] completely oxidised starch to carbon dioxide and formic acid by distillation with sulphuric

acid and manganese dioxide. Chlorine dioxide does not attack starch in twenty-four hours and practically none of the reagent is used in this time,[202] but, although the microscopic appearance of potato and wheat starches is unchanged, Samec and Ulm[199] have found chemical changes in the treated starches, the phosphorus being removed. When, however, the starches are treated with chlorine dioxide and pyridine, oxidation does not occur. The action of chlorine dioxide on roasting starch might be of interest and no patents apear in this field.

Oxidation by Irradiation

Several workers[15, 152] state that irradiation of soluble starch brings about far-reaching oxidation in ten days at 45° C. Ono[169] reduced the viscosity of starch pastes by irradiation with ultrasonic waves and reported that some oxidation may have occurred.

Oxidation by Air in Acid Solution and by Ozone

The oxidation of starch in acid solution by bubbling air through has been patented.[26] The use of ozone for bleaching and deodorising amylaceous products such as dextrine, starch and flour is of commercial interest and may be briefly dealt with, as it is a method of improving existing products.

Gorup-Besanez[83] reported that potato starch in water was indifferent to ozone, showing no change in several days, and König,[138, 139] made use of this to bleach and deodorise amylaceous materials by passing ozone through solutions of starch or dextrine. Siemens and Halske[208] patented the preparation of an ozone starch by double treatment with chlorine and ozone, and Schaeffer and Scheurer[200] point out that these products vary in iodine colour from blue to violet and from insolubility in cold water to complete solubility, the latter giving strong reduction of Fehling's solution. Pieper[181] has covered the use of ozone to prepare clear dextrines and gums free from odour and repulsive taste, the ozone being passed over the starch during roasting. Friedenthal[69] mentioned that a commercial soluble starch known as ozone starch had a molecular weight of 9450. Löb[147] passed a silent electric discharge through 1% solutions of starch, and although there was evidence of much degradation he obtained no true criterion of oxidation.

2. OXIDATION OF STARCH IN ALKALINE MEDIA

In alkaline media the various enolisation reactions of Nef,[164] such as were found by Evan *et al*[27] for sugars in alkaline solution, can occur previous and concurrent to oxidation. The action of alkaline oxidising solutions would, therefore, be expected to produce oxidised forms of hydrolysed and enolised starch. Theoretically, no hydrolysis should occur, but in practice the increase in reducing power of starch upon heating in alkali is evidence to the contrary.

Oxidation by Hypoalites

I. *Alkali hypochlorite.*—A number of workers[43, 201, 220, 143] have dealt with the production of soluble starches by the action of sodium or calcium hypochlorite, and in view of the cheapness of the process and the excellency of the products we will deal with it at somewhat greater length than the previous sections.

Sodium or calcium hypochlorite is one of the commonest agents used in the commercial oxidation of starch,[102] producing a wide variety of products depending on the concentration of hypochlorite, the temperature of reaction and the time the oxidation is allowed to proceed.[207] The products are used in the textile, paper making and adhesive industries. One process consists in making a suspension of the starch having a density of about 20° Bé. and adding the hypochlorite solution, containing 7-8% active chlorine, in small portions at a time. When, by previous experience, the reaction is judged to be approaching completion—for example, after eighteen to twenty-four hours—a sample of the suspension is withdrawn, rapidly filtered and washed on a vacuum filter; it is then slurried with a given amount of water, the suspension neutralised, heated to 80° C. and the viscosity determined. When the desired viscosity has been reached the process is stopped, the mass thoroughly washed, de-watered to about 40% moisture content and dried.[104]

J. A. Montgomery[157] treats the starch with 10% or more by weight of alkaline hypochlorite in aqueous solution at 130-160° F. This worker adds 2% of formaldehyde to correct the colour when the final stage has been reached, and claims the product to be of value in the sizing of paper or for mixing with wax emulsions for waterproofing paper. He notes that the reaction is exothermic, and a word or two may be said on this important fact.

Haller[105] noted a temperature rise which depended on the amount of hypochlorite used, and Rassow[180] measured this effect as well as the decrease in viscosity and the increase in reducing power. Rassow and Lobenstein[180] attributed the temperature effect partly to heat of adsorption, partly to heat of decomposition of the hypochlorite, and partly to heat of oxidation of the starch. In the manufacture of soluble starches commercially by the "wet process" the rise in temperature must be strictly controlled, otherwise, as pointed out by the writer elsewhere,[183] the final properties of the starch will not be those desired. Furthermore, it is desirable to avoid local concentrations of hypochlorite when running it into the mixing vat. This can be achieved by vigorous agitation or by spraying it into the agitated liquid.

Completely dried starch gives an even more vigorous reaction, probably due to the added effect of heat of hydration or heat of swelling. Use of this has been made by several workers.[93, 214]. Haake[93] treats starch with 10% of 28° Bé. sodium hypochlorite, and the heat of reaction serves to evaporate the moisture and leaves a nearly dry product. Another patent sprays, a portion at a time, 2,500 c.c. of a solution of sodium hypochlorite containing 8% available chlorine and 2% sodium hydroxide on to 20 lb. of starch continuously agitated in a water-jacketed pan. Cold water is circulated in the first fifteen minutes. At the end of the next fifteen minutes all the hypochlorite solution has been added, temperature has fallen to 30° C., and the moisture content of the mix is about 32%. The mass is then dried to a water content of 15 to 20%. The product is claimed to be valuable for coating paper for lithographic printing because of the increased hardness and increased resistance to ink penetration it imparts. The process can be applied to all starches: for example, maize, potato and tapioca starches.

In the surface sizing of paper ordinary starch forms gels which are too viscous. The gels of "chlorinated"

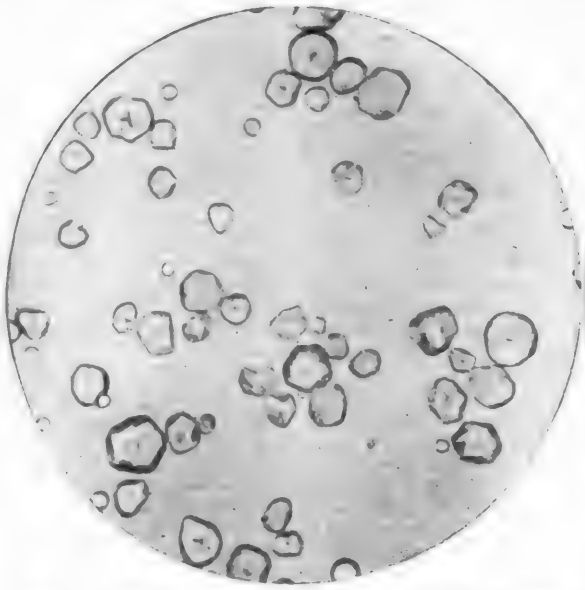


Fig. 1.—Maize starch, shown above, is generally modified by oxidation.

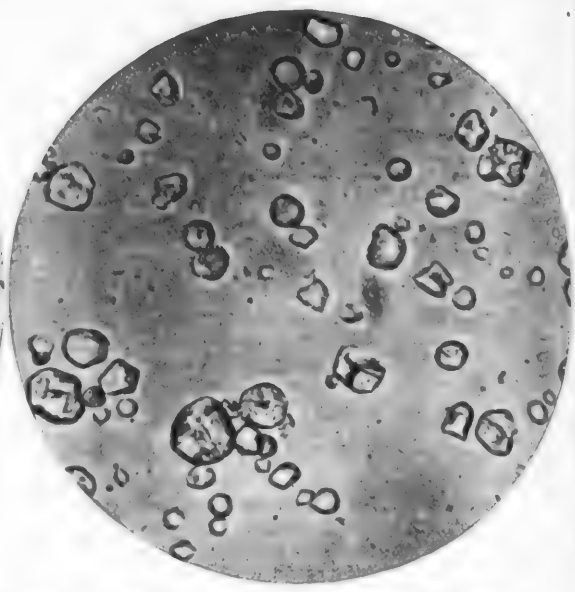


Fig. 2.—Thin-boiling maize starch made by oxidation.

Both photographs are reproduced by courtesy of Chapman and Hall, Ltd., from "Starch and its Derivatives," by the author.

starches have greater fluidity. The limited "setting-up" of high-grade tapioca starch paste is transferred to other kinds of starch—*e.g.*, maize and potato—by hypochlorite oxidation. These oxidised starches have found use in the mill sizing of textile fibres. Oxidation beyond the thin-boiling stage produces cheap, rapid drying and efficient adhesives.[47] These adhesives may contain as little as 8% or as much as 50% starch.

No sharp differentiations between the abilities of oxidised and native starch to be stained by many dye-stuffs of different types can be observed. Samec and Blinc[197] allowed alkaline hypochlorite to act until a test sample of the starch went into solution at 95° C. The microscopic appearance, including the shape and birefringence, was very little changed, although some granules showed cracks and stratification.

Fletcher and Taylor[61] treated maize α-amylose with alkaline hypochlorite at *p*H 10 and *p*H 13, and whilst the viscosity remained practically constant for thirty days the alkali-labile value and initial reducing value fell practically to zero. They surmised the reaction was primarily an oxidation of aldehydic end-groups but that some disintegration of the carbohydrate accompanied this change.

Kanitkar[127] used ammonium hypochlorite to oxidise corn starch, and confirmed an earlier conclusion[126] that the copper numbers of the cellulose increased with decreasing alkalinity of the hypochlorite solution. A number of patents dealing with the modification of starch by alkaline hypochlorite are included in the bibliography (refs. 16, 25, 31A, 38, 40, 46, 73, 74, 82, 89-93, 114, 116, 120, 123, 157, 163, 190, 204, 214, 222, 230, 223).

II. *Alkaline hypobromite.*—Only two workers appear to have paid any attention to the oxidation of starch with bromine in the presence of alkali. De Chalmot[36] and Hönig and Ruziczka[116] used sodium carbonate and barium hydroxide respectively as alkali, and although one patent[190] includes the use of bromates and hypobromites among many other chemicals claimed, the bromine oxidation process has attained no commercial importance.

III. *Alkaline hypoiodite.*— Myrbäck[218] oxidised the reducing end-groups of starch with 0·054 equivalent of iodine per glucose unit. The oxidised starch gave the same yield of maltose by α- or β-amylase as raw starch.

Oxidation by Alkaline Chlorite

Liebig[145] noted that starch was attacked only with difficulty by salts of chlorous acid, but the textile industry[45] has found an application for sodium chlorite in kiering operations to remove starch.

Oxidation by Alkaline Activin

A number of workers[50, 53-56, 68, 98, 102, 106, 107, 229, 231] have reported on the production of soluble starch by means of Activin (sodium-*p*-toluenesulphochloramide). This compound liberates chlorine at a definite rate when heated with water. By heating with Activin and water the starch is gelatinised and thinned, and it is interesting to note that the oxidation and solubilisation of the starch take place without any appreciable formation of dextrines or sugar.

Oxidation by Alkaline Permanganates

Gummy materials of a dark colour were obtained by early workers[143, 146, 225] by permanganate oxidation, and as all of the gums were acidic, Lintner called them dextrinic acids. Schmerber[201] reported a decrease in viscosity and increase in transparency upon oxidation of starch with 0·015 equivalent of potassium permanganate, and on distillation of an oxidised starch

with 12% hydrochloric acid considerable furfural is said to be evolved.[151]

The general effect of a light treatment with permanganate on starch is to give a product which produces a more fluid and transparent paste (the removal of the yellowish tinge is discussed below), and the action of the permanganate can be followed by the iodine reaction of the product in solution, which gives blue, blue-violet, reddish-violet and reddish-brown colours at successive stages of the reaction. This and determination of the viscosity allows the manufacture to be followed and stopped at any desired stage (see "Starch and its Derivatives," London).

Some interesting work has been carried out by Fosse,[64] who found that dextrine treated with a large amount of calcium permanganate in the presence of ammonia yielded 0·57% urea at room temperature and 2·85% at 95° C. In the presence of cupric carbonate 2·57% urea was obtained from dextrine and 2·0% of urea from starch. Heating the last two mixtures at 95° C. increased the yields to 21·85 and 24·28% respectively. Later Fosse[65] found that sugars, dextrine and starch treated with a solution of calcium permanganate, ammonia and silver nitrate gave about 1% hydrocyanic acid. These results are, of course, only of academic interest.

Samec[195, 196] observed an increased conductivity and an increased acidity of the dialysed gel-phase of a permanganate-oxidised starch and considered that carboxyl groups had been formed by oxidation and contributed to the acidity of the product. For the dialysed sol-phase of this product, however, the gram atoms of phosphorus and the equivalents of titratable acidity were practically identical.

Nakamura[160] found that potassium permanganate decreased the phosphorus content of starch to a greater extent than did ammonium persulphate or sodium perborate. The viscosity was decreased over that of the original starch and the products were more readily acetylated. Permanganate was also used by Haller[105] for very mild modification.

"Permanganate starches" sometimes have a yellowish tinge due to retention of some manganese, but after-treatment of the starch with sodium hydrosulphite, sulphur dioxide or dilute oxalic acid solution will greatly improve the colour, rendering the product suitable for use in textile printing and sizing and in the adhesive and paper-making industries.

Randall, Benger and Croocock,[186] found that the ease of oxidation with alkaline permanganate of glucose, maltose, starch, methyl glucoside and cellulose diminished in that order. Symons and Buswell[223] found that the biochemical oxygen demand (BOD) of starch under the conditions of the common test was 79 to 88% of the theoretical.

The patents on permanganate oxidation have been listed.[19, 34, 131, 161, 191, 202, 210]

Oxidation by Alkaline Peroxides

A useful commercial method of modifying starch is by the use of alkaline peroxides which can be mixed as dry powders with the starch. On making the starch paste modification occurs. According to Wurster,[242] at ordinary temperatures alkaline peroxide hardly attacks starch, but does modify starch in boiling solution to dextrines and glucose. Von Asboth[232] treated starch rather drastically, adding hydrogen peroxide made alkaline with ammonia to a boiling starch paste, and obtained a variety of products by fractionating the resultant mass.

Syniewski[224] used a cold solution of sodium peroxide, and in one hour none of the above drastic changes occurred. Although the product was soluble to 12·5% in cold water and completely soluble in hot water, it nevertheless gave a blue iodine colour, no reduction of Fehling's solution, and showed retrogradation on standing, and this type of product should be of use in the paper-making and textile industries. He considered[225, 226] that sodium peroxide did not oxidise the starch but merely solubilised it.

When starch is oxidised according to Syniewski's method, but using a time of two hours instead of one, the product is easily soluble in water, showing some reducing power and a lowered viscosity.[196] Extending the time of oxidation to six hours still produces only a mild oxidation, as evidenced by the acidity, iodine colour, viscosity and osmometric molecular weight.[195, 196]

The author has dealt fully elsewhere with adhesives made with hydrogen peroxide.[185] These adhesives have the advantage that they can be made with a wide range of total solids and therefore can be applied for widely varying uses.

Two patents cover the use of barium peroxide for oxidation,[111, 183] and other peroxides have also been claimed in patents.[39, 62, 90, 178]

Oxidation by Air in Alkaline Solution

Dhar and co-workers[41, 155, 171-175] passed air through alkaline solutions containing carbohydrates and an oxidisable substance such as sodium sulphite, ferrous hydroxide or cerous hydroxide. This latter substance underwent oxidation at room temperature and induced the oxidation of the carbohydrate. The amount of oxidation in a given time increased with the alkaline concentration of the solution except when sodium sulphite was the inductor. One-tenth of a gram of starch in 100 ml. of solution containing cerous hydroxide or ferrous hydroxide was completely oxidised by 36·5 litres of air in 5·5 hours when the concentration of sodium hydroxide was 0·5 to 0·7%. Starch was found to be more easily oxidised than any of the several sugars used. This order does not agree with that determined by permanganate.[186] Sodium sulphite induced the oxidation of 26% of the starch even when no alkali had been added to the solution, but did not give complete oxidation at any alkaline concentration up to 0·7%. When air was passed through an alkaline starch solution containing no inductor, 23 to 35% of the starch was oxidised at different concentrations of sodium hydroxide. When the concentration of sodium hydroxide was kept constant, 31·7% of the starch was oxidised in 5·5 hours, while 45·3% was oxidised in 9 hours. But when sodium bicarbonate was substituted for the sodium hydroxide the values were 35·9% and 31·9% respectively, showing a decrease on longer oxidation. Similar experiments were also carried out on glycogen.[174]

Further experiments by Dhar and associates,[173, 175] studied the effect of sunlight on the oxidation of carbohydrates by air in neutral solution; 36·5 litres of air passed through starch solution in 5·5 hours oxidised 35·6% of the starch in tropical sunlight, 38·8% in sun-

light of greater intensity, 66·9% in the latter case if zinc oxide (a photosensitiser) was present, 92·9% if the photocatalyst was ferric nitrate, and 100% if the photocatalyst was uranium nitrate. In the photochemical oxidations as in the induced oxidations starch was oxidised more easily than any of the sugars or glycogen.

Samec[185, 186] passed air for three days through a 15% starch suspension which was 0·05 N in sodium hydroxide and obtained very little evidence of oxidation as the molecular weight was high, the iodine colour blue to lilac, the titratable acidity and the percentage of dialysable substance very low.

In the production of dextrines by dry heating in air at 200° C., Katz and Weidinger[130] found a measurable acidity due to weak oxidation, for in an atmosphere of nitrogen no acidity was developed.

Starch was oxidised by Baudisch and Deuel[5] for 48 hours with sodium penta-cyanoaquaferroate and oxygen.

The oxidation of starch by air has likewise been patented,[171] but further work directed towards the production of commercially useful products is required in this field.

Electrolytic Oxidation

Leconte[142] used electrolysis as one step in the preparation of a very white grade of rice starch. An alkaline suspension of the starch was electrolysed between aluminium, zinc or other metallic electrodes. Harvey[110] and White[226] patented a process for the Perkins Glue Company which was designed to convert starch to a glue. An aqueous suspension of the starch was made, conducting by the addition of hydrochloric or sulphuric acid a salt or alkali. Iron or carbon electrodes were used with a direct current of 3·5 amperes at 100 volts. The electrolysis was stopped before the starch reached the soluble stage. It is apparent that some oxidation occurred due to the products of electrolysis of the conducting substances. Siemens and Halske[209A] and F. Hermite[115A] used similar methods with sodium or magnesium chloride as the electrolyte.

Fink and Summers[60] attempted without success to electrolyse starch between graphite electrodes in 2% potassium bromide solution at 40° C. kept neutral by means of calcium carbonate. The electrolytic production of oxidised starch would, no doubt, be of interest where cheap hydroelectric power is available and should give products of interest to the food industry as well as the textile, paper and adhesive industries.

Oxidation by other Alkaline Compounds

Brown and Millar[24] oxidised several different *dextrines* by heating at 100° C. with mercuric oxide in barium hydroxide solution. In these conditions oxidation proceeds farther than the conversion of the aldehydic group of the terminal glucose unit to a carboxyl group. The resultant products would appear to have no commercial importance.

Oxidation by Alkaline Persulphates

According to Trotman,[220] 0·036 equivalent of persulphate made alkaline by ammonia modified starch, and the product is of value for cotton sizing. Supf[221] has patented the alkaline persulphate oxidation, but this patent will probably have lapsed by now.

" The Oxidation of Starch " will be continued in the next issue. Publication of the complete list of references will be made in the concluding instalment.

Daylight in Factories

It may not be generally known that the policy of Government departments has changed since the effects of enemy action upon factory roof lights have been investigated. Prior to serious air raids the advantage and desirability of giving daylight in factories was fully recognised, and gradually the use of shutters was becoming almost universal. Inspection of the new factories affected by air raids gave the authorities the impression that it was necessary to eliminate roof lights completely from new designs, and where practicable remove existing glass. Also it was considered that the effect of blast upon mechanical shutters was such as to incur excessive cost of reinstatement and maintenance of this equipment.

A committee has been formed by a substantial body of manufacturers and engineers intimately connected with the development of products and mechanical devices now perfected for the provision of daylight working conditions, combined both with safety for the workers and satisfactory black-out during hours of darkness.

It is hoped, with the co-operation of the various public bodies concerned with the problem, to exert sufficient influence to bring about the consideration of the waste, depression and ill-effects on health created by the continued use of artificial lighting in the hours of full daylight.

The principal objects of the committee are as follows:

1. To encourage the use of daylight in factories and abolish the permanent black-out conditions and thus—

   (*a*) Improve working conditions for employees.
   (*b*) Increase daytime production.
   (*c*) Effectively reduce consumption of electricity and fuel.

2. To promote non-commercial co-operation between manufacturers of any products relating to the question, and pool information and improvements in order to eliminate waste and to offer the most suitable schemes for the national effort.

3. To present to the appropriate Government Departments and others concerned all the available data on the benefits of working under daylight conditions; and bring to their notice all the available methods and materials.

A booklet giving the main reasons why daylight should be reintroduced, and reliable methods of accomplishing this, has recently been issued. The case for daylight working is argued from the angles of—

1. Saving in fuel and electricity.
2. Effect of black-out conditions on production.
3. Effect of black-out conditions on workers.

The methods of restoring daylight conditions are fully considered, and the capital cost of shutter installations compared with annual expenditure on artificial lighting. With the basic area for comparison taken as 100,000 sq. ft. floor space, figures are given which show that the cost of daylight installations according to different schemes is repaid by the saving in artificial light and lamps alone in one case in 8½ months and in another 14 months. In neither case has any account been taken of the saving due to increased rates of production, improved health, etc.

An appendix contains extracts from various publications relating to factory lighting and supplies—a handy *précis* of expert opinion on the subject.

Automatic Control of Air-Conditioning Plant

FRANK H. SLADE, A.M.I.Mech.E.

THE MAIN object of an air-conditioning plant in food manufacture is to produce environmental conditions other than are normally available, enabling production costs to be reduced by the elimination of waste, or processes to be carried out that would otherwise be unsuccessful under either natural conditions of temperature and humidity, or the environmental conditions prevailing in any working space. The efficiency of a plant producing these beneficial results, from a processing viewpoint, is the closeness of the limits within which temperature and humidities can be controlled. Practice has proved that the only effective and economic method of close control is by the use of automatic devices.

Therefore, providing the control system is correctly designed, interlocking and co-ordination of the functions of an air-conditioning plant can be accomplished in a manner that would not be possible with manual control; or it can be said that the accurate performance of an air-conditioning plant is dependent upon its automatic control equipment, and as the cost of such control is but a fraction of the entire system, the use of the proper type of regulation is always sound economy.

To secure the maximum return on the investment in automatic control equipment it is exceedingly important that proper selection of the requisite apparatus be made when installations are being planned, and in view of this it is best that the fundamentals of available equipment be understood.

Why Automatic Control ?

It is an easy matter to speak or write about economies that are to be expected by the use of certain equipment, but the fundamental point to be considered is why economies and benefits are to be obtained by their application.

The A.S.H. and V.E. Data book very skilfully summarises why automatic control should be an integral part of an air-conditioning plant, as follows :

1. To ensure the maintenance of certain desired or required conditions of temperature, pressure, humidity, air motion or air distribution.

2. To secure a safety factor, limiting pressures or temperatures within predetermined points, or preventing the operation of mechanical equipment unless it may function without hazard.

3. To produce economical results and thereby ensure operation of the system at a minimum of expense.

Control Groups

No set system of control can be laid down, insomuch as there is no air-conditioning plant standard to all applications. Each particular case has to be considered on its merits, and a design effected to suit the particular requirements; nevertheless, the fundamental principles of design are the same and can be readily outlined. There are three main groups of controls, and their classification is dependent upon their source of operating power. These are electric control, pneumatic control and self-contained control systems.

In the first system the source of power operating the control mechanism is electricity; that is, the controlling mechanisms such as electric motors, motorised valves, dampers, solenoids, relays, etc., are operated by the primary controller switching an electric circuit. In one case of temperature control a thermostat would operate a switching device " making " or " breaking " an electrical circuit directly connected, or connected through a relay for power amplification to a motorised valve governing the flow of fluid to the space being either cooled or heated, thereby completing or discontinuing the circuit carrying the commands of the controller to the controlled valve.

The pneumatic control system needs compressed air for its operation. The pressure of the compressed air is governed by the primary controlling device through leak valves, and by means of this pressure variation the valve being automatically controlled is energised to the extent of the control required.

As the name implies, the self-controlled system is one whereby the movement required at the point being controlled is transmitted directly by the primary controller. This is in the form of a volatile liquid enclosed in a phial, and is used for temperature control, variations in temperature causing expansion and contraction of the liquid within the phial, the variation being transmitted directly to the mechanism being controlled.

In all of the foregoing groups of control the primary regulators are thermostats and humidistats or hygrostats. The former of these, as the name implies, is a temperature-sensitive element, and the latter is an element sensitive to changes in hygrometric conditions.

Thermostatic Control

Thermostats are temperature-sensitive devices reacting to temperature changes, the temperature-sensitive element being in either of three types : (1) bi-metal, (2) vapour-filled bellows and (3) rod and tube.

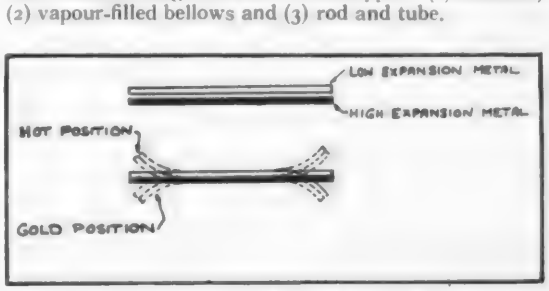


FIG. 1.—BI-METAL ELEMENTS.

Bi-Metal-Type Elements. Thermostat metal is defined as a composite metal usually in the form of sheet or strip, comprising two or more metals which, by virtue of the differing expansivities of its components, tend to change its curvature when subjected to uniformly distributed changes in its temperature. This is illustrated diagrammatically in Fig. 1.

Under the influence of temperature changes the expansion of one of the metals at a greater rate than the other causes bending of the associated strip, and a resultant movement and power which can be utilised to actuate contacts in the electrical control, or the leak valves in the pneumatic type of control.

The types usually used are either straight-strip, helix or curved-strip type.

Vapour-Filled Bellows or Bellows-Type Element. In this a diaphragm or a corrugated metal bellows is used as the means of transmitting motion. It is usual to utilise a closed assembly containing a volatile liquid which vaporises or condenses on rising or falling temperature. The pressure fluctuations during the process of vaporisation and condensation react in movement of the flexible diaphragm or bellows, and in turn is transmitted to the electrical, pneumatic, or self-contained control system.

Rod-and-Tube-Type Elements consist of a rod of metal or carbon fastened to a sealed tube of metal having a different coefficient of expansion. A junction is provided at one end only, so that on fluctuating temperatures the rod and tube, expanding at different rates, will provide motion and power to actuate the electric or pneumatic control systems.

Types of Thermostats

These types are manufactured in four forms, and are: (1) Room Thermostats, (2) Immersion Thermostats, (3) Insertion Thermostats and (4) Surface Thermostats.

Room Thermostats. It is usual to install this form of thermostat on the wall of the space wherein the temperature has to be controlled. Fluctuations in temperature within this space will operate the thermostat, which in its turn will cause the operation of the plant controlling the temperature. The element in these is normally bi-metallic strip or coil, or vapour-filled bellows.

Immersion Thermostats. These are used for the temperature control of liquids, and the sensitive element usually consists of bi-metallic coil rod or tube or thermal expansion rod or vapour-filled system.

Insertion Thermostats. A similar construction to the immersion thermostat, but the fluid to be controlled is in the form of a gas and not a liquid; therefore the protective case around the sensitive element to prevent mechanical damage must be so constructed that the fluid must be in direct contact with the sensitive element.

Surface Thermostats. These measure surface temperature only; therefore, if an indirect means of controlling the temperature of a liquid or gas flowing in a pipe is required, a surface thermostat is used, its method of operation being similar to the three other forms of thermostats described.

Controlling Devices

Humidistats, as already explained, are elements sensitive to the changes in hygrometric conditions, or elements that are manufactured from materials that are sensitive to changes in humidity. The material comprising the sensitive element may consist of hair, paper, wood, skin or similar hygroscopic material that when properly treated will not react to other than hygrometric conditions. Therefore humidistats or humidity controls can be defined as automatic devices reacting to changes in relative humidity. These are also available as a manufactured article, both temperature- and humidity-sensitive elements being designed to control dry bulb temperature and relative humidity within a given space.

Further controlling devices used in an air-conditioning installation are Relays, Pressure Controllers, Damper Motors, Solenoid Valves and Control Valves.

Relays are a device installed between the controller (thermostat or humidistat) and the device under control whereby the capacity of the controller is amplified or an auxiliary function is performed—*e.g.*, electric motor control is usually effected by relay action; that is, the controller operates the relay, and the relay, in turn, operates the electric motor. There are many examples where a relay is necessary, but it can be stated that a relay is needed in all cases where to provide sufficient power at the sensitive element to operate the controlling device would seriously impair its sensitivity.

Pressure Controllers are devices reacting to fluctuations in pressure. Examples of these are pressure controls governing the operation of refrigerating plant, steam and water controls, etc.

Damper Motors are motors actuating dampers controlling the flow of air to, and conditioned air within, a distribution system. These motors are connected by suitable linkage to the dampers and are energised by either thermostat, humidistat or pressure controls, either directly or through suitable relays.

In solenoid-operated valves, the solenoid is energised either to open the valve or close the valve, depending upon the application to which it is applied. These are usually utilised for refrigerating machine control or for the control of the flow of water to humidifiers.

Control Valves

Control Valves are all valves that are actuated by controllers to regulate the flow of a medium passing through them. They may either be operated by the electric or pneumatic control systems, and can be positive-acting, graduated-acting or self-contained.

Positive-Acting or Two-Position Control, as the name implies, operates in two positions only—that is, open or shut, or on and off positions. Therefore a thermostat "starting or stopping" an electric motor is an example of this form of control. When applied to valves, dampers, etc., they would only operate in two positions—that is, "open" and "closed".

Graduated-Acting or Modulating Control is the type of control causing motion in the controlled device in proportion to motion caused in the controller by fractional degree variations in the medium to which the controller is responsive. The operation would be that after a fractional change has been measured by the controller this is transmitted to the valve or damper being controlled in proportion to this fractional change. A new position is registered by the valve or damper, and the system remains static until further movement is measured by the controller.

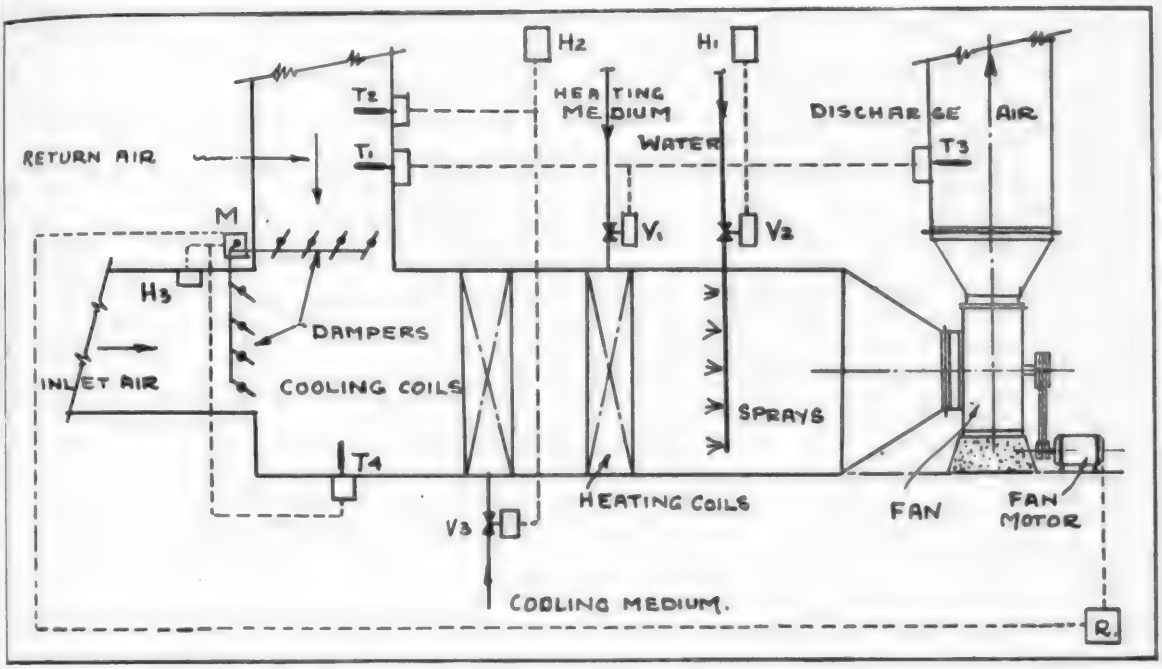


FIG. 2.—DIAGRAM OF CONTROL SYSTEM.

T1. Thermostat in room or return air (heating cycle).
T2. Thermostat in room or return air (cooling cycle).
T3. Thermostat as low-limit control.
T4. Inlet air thermostat.
H1. Humidity control of conditioned space (heating cycle).
H2. Humidity control of conditioned space (cooling cycle).
H3. Inlet air humidity control.
V1. Modulating control valve controlling heating medium.
V2. Control valve to sprays operated by H1.
V3. Modulating control valve controlling cooling medium.
M. Damper motor controlled by T4.
R. Relay setting "M" to close inlet dampers when fan motor stops.

By this means the flow of liquid or gas is modulated between extreme limits in proportion to the flow required by the process wherein control is being effected.

Control Points

The foregoing is a description of the apparatus whereby automatic control can be obtained. As already stated, there is no air-conditioning system standard to all applications, every particular process needing a varying design of air-conditioning plant, and in consequence a control system to suit both plant and process. This applies both to the plant for process work and plant for process workers. In a plant for general purposes it will be found that control of three main points are inserted. That is:

1. The space being conditioned.
2. The space wherein the air is to be delivered.
3. The source whereby temperature variations are effected.

The control of each of these is interlocked in such a manner that the co-ordination of the functions of the whole plant is possible.

The first control to be considered will be the space that is to be conditioned, and this can be effected in three ways. There are: (1) Individual Control, (2) Single Thermostat Control, (3) Zone Control.

Individual Control, as the name implies, is where each room in a building is individually controlled by controllers within that room, or in the case of a large room by more than one controller, in order that a proper measure of the conditions within that space are obtained. This method of control is the most accurate and flexible means of regulating temperature and hygrometric conditions.

Single Thermostat Control is used when constant conditions are required in any given number of rooms. One room is chosen as an index room, the controller situated in this determining the conditions throughout all the other rooms. As can be understood, differences in control are to be expected from this method, for to be able to obtain a perfect balance between all rooms controlled by one set of controllers is a very difficult problem.

Zone Control is usually applied to very large spaces. The space is split up into areas or zones, each zone being provided with its own set of controllers, which function to regulate the conditions within that particular zone.

Conditioning Plant Control

Fig. 2 illustrates a control for conditioning system consisting of the combination of a ventilation, heating and cooling system; this system provides for all-the-year-round air-conditioning, and the method of control is as follows:

Constant temperature conditions within the space being conditioned are maintained by Thermostat T2,

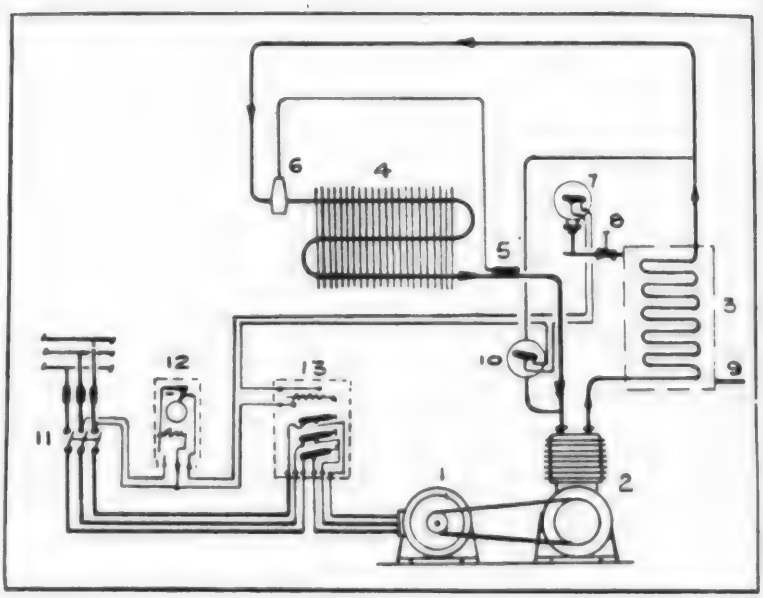


FIG. 3.—AIR COOLING (DIRECT).

1. Electric motor.
2. Refrigerator compressor.
3. Condenser.
4. Direct expansion coil.
5 and 6. Thermostatically controlled expansion valve.
7. Water pressure regulator.
8. Shut-off valve (condenser water).
9. Condenser water waste.
10. Pressurestat, with excess pressure control.
11. Main switches.
12. Time switch.
13. Distant control mercoid switches.

which operates modulating Valve V_3, controlling the flow of coolant to the cooling coils. Hygrometric conditions are controlled by Hygrostat H_2, which operates control Valve V_3 whenever the relative humidity with the space exceeds that which is required.

Low-limit control is obtained by the use of controlling Thermostat T_3.

Constant temperature conditions within the space being conditioned are maintained by Thermostat T_1, which operates modulating Valve V_1 controlling the heating medium to the heating coils.

Hygrometric conditions are controlled by Hygrostat H_1, which operates control Valve V_2 admitting water to the sprays whenever humidification is necessary; low-limit control is obtained by Thermostat T_3, which operates Valve V_1 whenever the temperature falls below that which is required.

Inlet dampers are controlled by Hygrostat H_3, which obtains its control from external hygrometric conditions balancing minimum damper opening by external humidities. Damper Motor M is also actuated by Relay R, which is controlled through the fan motor.

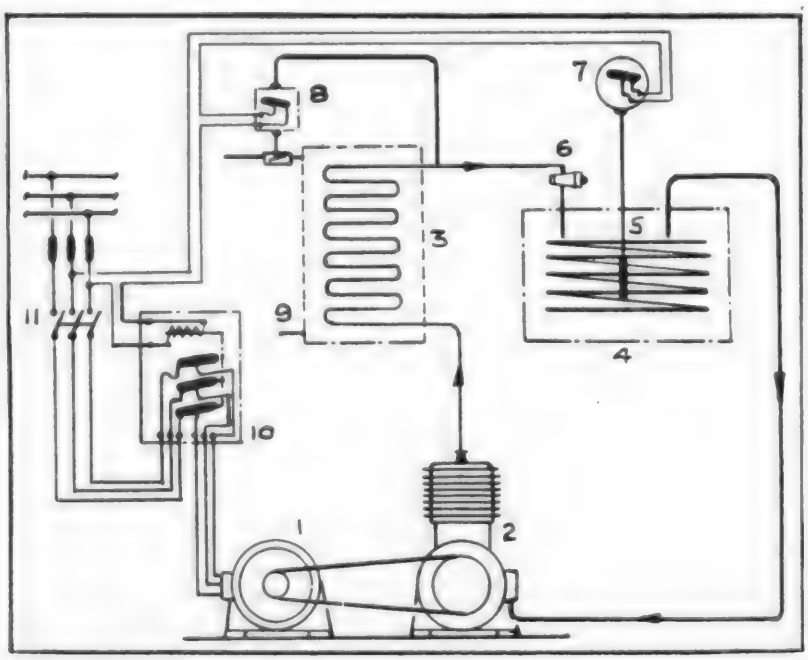


FIG. 4.—AIR COOLING (INDIRECT).

1. Electric motor.
2. Refrigerating compressor.
3. Condenser.
4. Evaporator.
5. Evaporator tank.
6. Automatic expansion valve.
7. Capillary-tube thermostat.
8. Excess pressure cut-out.
9. Water exit.
10. Distance switches.
11. Main switch.

Cessation of fan operation will operate Relay R activating Damper Motor M, which closes the dampers illustrated in the diagram.

Heating and Cooling Units

The heating and cooling units are controlled by the conditions required at the heating and cooling coils, taking the cooling or refrigerating unit as an example, this being a unit in which the same control can be applied to more than one purpose in the food industry. From Figs. 3 and 4, together with the accompanying nomenclature, the use of the control gear is self-explanatory. This system can be utilised for the cooling of air in a conditioning system, or the direct cooling of air in a cold chamber by the direct-expansion coils. The temperature to the coils is regulated by a thermostatically controlled expansion valve (vapour-filled type). The compressor is controlled by a pressurestat fitted with an excess pressure switch, operation being by distant-control switch. Also operating in conjunction with a pressurestat is a diaphragm-type condenser-water control switch, which comes into action in the event of water failure—*i.e.*, negative fluctuation in the supply of water to the condenser causes the diaphragm to operate a mercoid switch, which in turn controls the distant-control mercoid switches.

The time switch determines the period of time during which the machine should operate—that is, peak or working load periods.

Automatic Water Control

Fig. 4 illustrates a system of automatic water control. The system controls a water-cooled indirect cooling system, the evaporator cooling a liquid tank—*i.e.*, brine or water. Liquid refrigerant is controlled by an automatic expansion valve, and the compressor is controlled by a capillary-type thermostat, the phial of which is situated in the evaporator tank, and its action is relayed together with that of the condenser-water control switch through a distance switch to the electric motor.

The foregoing is but a brief summary of automatic control as applied to air-conditioning plant. It must, however, be borne in mind that with the multitude of systems of air treatment to be applied to the various processes called for in food manufacture no set system of control can be specified to suit all purposes; but no matter what system is used, if it is correctly designed—that is, a discreet combination of what has already been described—it will be found that the automatic control equipment will, by reason of its efficiency and economical operation, pay for its installation costs many times over.

Walnuts as Source of Vitamin C

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Author of "Spices and Condiments", etc.

SINCE the discovery that the antiscorbutic properties of the juices of *Citrus* fruits (notably lemons and oranges) is due to the presence in them of a specific substance (vitamin C, ascorbic acid, or cevitamic acid) whose identity has been established and which has been synthesised, search has been made for other natural sources of this substance, which, actually, is widespread in nature, occurring in many fruits and vegetables, though frequently in very small amounts.

A notable achievement was that of Banga and Szent-Gyoergyi, who, from the fruits of Hungarian-grown paprika (*Capsicum annuum* var.), extracted 3 kg. of pure ascorbic acid (*Biochem. J.*, **28**, 1934, 1625). According to these authors, the juice of this fruit contains from 2 to 2·5 gm. of the vitamin per litre. Later, Szanyi (*Természettudományi Koezloeny*, **67**, 1935, 527) obtained a higher figure—namely, 3·160 gm. per kg.

These figures are considerably in excess of corresponding figures for orange juice, the average vitamin content of which may be taken as about 0·58 gm. per kg.

The war has acted as an incentive to the search for natural sources of ascorbic acid in this country, owing to the difficulty in importing adequate supplies of oranges and lemons and the fact that the cultivation of red peppers is difficult under prevailing climatic conditions.

Redcurrant juice was found to be at least as rich in the vitamin as is orange juice, and blackcurrant juice almost twice as rich. Charley and Sills (*Long Ashton Report*, 1940, 125) have published figures for blackcurrant juices treated in different ways, ranging from 0·744 to 1·066 gm. per litre.

Later came the discovery that rose-hips provided an important source of ascorbic acid (Andross, *Analyst*, **66**, 1941), analytical figures obtained varying from 3·70 to 6·23 gm. per kg. of the fruits.

Steps were taken by the Government, in consequence of these discoveries, to conserve blackcurrant syrup (3 gm. ascorbic acid per kg.) and rose-hip syrup (2 gm. ascorbic acid per kg.) for the use of children and for medical purposes, while the sale of oranges is also largely restricted to parents having young children.

All this has been done in ignorance of the fact that there is in this country a fruit—namely, that of the walnut, *Juglans regia*—far richer in vitamin C than any of the previously mentioned products, although the fact had been made public so far back as 1937, in which year Gergelezhiu announced that he had obtained from this source from 10 to 30 gm. ascorbic acid per kg. (*Bull. App. Bot. Gen. U.S.S.R., Supp.* 84, **2**, 1937, 206). Indeed, apart from Kennig and Ohske (*Biochem. Z.*, **308**, 1940, 16), no scientists outside of Russia appear to have paid the attention that this deserved to Gergelezhiu's important discovery.

At last, however, Gergelezhiu's work has received recognition in this country, and in a highly important communication to *Nature* for August 29, 1942, Pyke, Melville and Sarson give the results of their own investigations.

Gergelezhiu showed that vitamin content was at a maximum when the kernel of the fruit was soft, just before formation of the shell. Examined at this stage, fruits of the edible walnut, *Juglans regia*, were found by Pyke, Melville and Sarson to contain from 1·460 to 1·800 per cent. of ascorbic acid. Somewhat lower figures were obtained for fruits of other Juglans species, but the authors state that the figures for the less common species must be taken as approximate only, since it was not possible to ensure examination of these at the optimum period of vitamin C development.

A number of other nuts were also examined. All were found to contain the vitamin, but in less high proportions than the edible walnut, and in some cases in quite low proportions. The most interesting figures were obtained for Rehder's wingnut, *Pterocarya Rehderiana* (1·540 per cent.), and hickory nuts from *Carya ovata*, var. *pubescens*; *C. ovalis*, var. *obcordata*; and *C. glabra* (0·820, 0·580 and 0·460 per cent. respectively).

The question of the retention of the vitamin when walnuts are pickled or worked up into other attractive products for the table received attention.

The authors state that the commonly adopted method of preparing pickled walnuts in this country completely destroys the vitamin content. On the other hand, the methods described in Mrs. Hannah Glasse's once-famous cookery book are completely satisfactory.

As this book may not be readily accessible to many readers, Mrs. Glasse's recipes are here quoted in full.

To Pickle Walnuts Green

"Take the largest and clearest you can get, pare them as thin as you can, have a tub of spring-water stand by you, and throw them in as you do them. Put into the water a pound of bay-salt, let them lie in the water twenty-four hours, take them out; then put them into a stone jar, and between every layer of walnuts lay a layer of vine leaves at the bottom and top, and fill it up with cold vinegar. Let them stand all night, then pour that vinegar from them into a copper, with a pound of bay-salt; set it on the fire, let it boil, then pour it hot on your nuts, tie them over with a woollen cloth, and let them stand a week; then pour that pickle away, rub your nuts clean with a piece of flannel; then put them again in your jar, with vine leaves, as above, and boil fresh vinegar. Put into your pot to every gallon of vinegar, a nutmeg sliced, cut four large races of ginger, a quarter of an ounce of mace, the same of cloves, a quarter of an ounce of whole black-pepper, the like of Ordingal pepper; then pour your vinegar boiling hot on your walnuts; and cover them with a woollen cloth. Let it stand three or four days, so do two or three times; when cold, put in half a pint of mustard-seed, a large stick of horse-raddish sliced, tie them down close with a bladder, and then with a leather. Take a large onion, stick the cloves in, and lay in the middle of the pot. If you do them for keeping, do not boil your vinegar, but then they will not be fit to eat under six months: and the next year you may boil the pickle this way. They will keep two or three years good and firm."

To Pickle Walnuts White

"Take the largest nuts you can get, just before the shell begins to turn, pare them very thin until the white appears, and throw them into spring-water, with a handful of salt as you do them. Let them stand in that water six hours, lay on them a thin board to keep them under the water, then set a stew-pan on a charcoal fire, with clean spring-water; take your nuts out of the other water, and put them into the stew-pan. Let them simmer four or five minutes, but not boil; then have ready by you a pan of spring-water, with a handful of white-salt in it, stir it with your hand till the salt is melted, then take your nuts out of the stew-pan with a wooden ladle, and put them into the cold water and salt. Let them stand a quarter of an hour, lay the board on them as before; if they are not kept under the liquor they will turn black, then lay them on a cloth, and cover them with another to dry; then carefully wipe them with a soft cloth, put them into your jar or glass, with some blades of mace and nutmeg sliced thin. Mix your spice between your nuts, and pour distilled vinegar over them; first let your glass be full of nuts, pour mutton-fat over them, and tie a bladder, and then a leather." (Mrs. Glasse: *The Art of Cookery, made Plain and Easy*. New edition. London, 1798, pp. 268 and 269.)

Modified Recipes

Messrs. Pyke, Melville and Sarson appear to have modified the recipes slightly, and give the following details:

"*Green Pickled Walnuts.*—Unripe nuts peeled very thinly; soaked for 24 hours in 15 per cent. salt solution; packed in spiced vinegar (without cloves); left for 3 months.

"*White Pickled Walnuts.*—Unripe nuts peeled until white; soaked for 12 hours in 15 per cent. salt solution; transferred to a second salt solution and simmered for 5 minutes; packed in spiced vinegar (without cloves); left for 3 months."

The authors state that samples of these pickles, prepared in 1940, gave the following astonishing figures for vitamin C content per 100 gm. when analysed in August, 1942: green pickled walnuts, 1,080 mg. (*i.e.*, 1·080 per cent.); white pickled walnuts, 1,070 mg. (*i.e.*, 1·070 per cent.).

Details are also given by the authors of some other walnut preparations of high ascorbic acid content, as follows:

"*Walnut Marmalade.*—230 gm. unripe nuts sliced into 560 ml. boiling water; boiled until soft (40 min.); 340 gm. sugar added, boiled until set (20 min.).

"*Walnut and Blackcurrant Jam.*—Jam made with 453 gm. nuts, 112 gm. blackcurrants and 560 gm. sugar.

"*Walnut and Green Tomato Chutney.*—680 gm. nuts, 453 gm. green tomato, 225 gm. shallots, 225 gm. raisins, 225 gm. sugar, 5 gm. mustard-seed, 15 gm. salt, 880 ml. vinegar, 25 ml. saccharine solution."

According to the authors, these preparations were found to contain the following amounts of ascorbic acid per 100 gm. respectively: 630 mg., 520 mg., 410 mg.

It is to be hoped that preparations of the types described above will be placed on the market at the earliest possible opportunity, and that, perhaps, they will be available for adult consumption.

The Sugar-Makers

The history of sugar teems with forgotten pioneers, many of whose names have been forgotten. This article recalls some of their work.

M. SCHOFIELD, M.A.

IN THE comprehensive literature devoted to sugar chemistry and technology, it is surprising how little acknowledgement is made of the epic struggle of pioneers who gave us the refined cane and beet product. The rationing of sugar to save shipping space is a reminder of the compelling rôle played by sugar in history. It recalls such striking effects as the rise of the beet-sugar industry because of a British blockade; for it was when we cut off supplies of cane-sugar to Europe by blockading ports in the Napoleonic wars that the rival industry was born. If one turns to the Revocation of the Edict of Nantes—an event with far-reaching economic effects—one can trace even here a connection. For that event, which drove refugees skilled in various trades to other lands, where their knowledge proved so beneficial, caused a French Protestant family to settle in Germany, and from that family was descended Francis Karl Achard, father of the beet-sugar industry. He was born a German instead of being French; it was Germany who ousted France in the new commercial adventure.

A Classical Story

Cane-sugar has all the lustre of the classics in its story. Long before the West Indies came into the picture the sugar-cane grew wild in Bengal before spreading to the Tigris and Euphrates valleys. Soldiers of Alexander the Great must have been the first Europeans to see the plant—though not necessarily to taste it. That its sweetness was recognised early is seen in the writings of Theophrastus, with his "honey which is from bamboos"; of Seneca, "There is found among the Indians a honey contained in the reed"; of Herodotus, Strabo and others harping on the same theme with "honey made by human hands" and "honey from canes". (Only Paulus Agineta struck a false note with his "Indian salt"!) "Arabia produces sugar, but that of India is most renowned", sang Pliny, who, in describing it as "white and brittle", suggests surprisingly that even in his day a refining process, probably wasteful, was at least known. One major point underlines all such early references: that the cane first flourished in India. Unlike the orange, with its habitat first thought to be India and since proved to be China, the history of the sugar-cane started correctly. The Chinese admitted they had acquired their knowledge of sugar-making from India round about 770 B.C. Centuries passed before sugar came to Europe, possibly with the Moors of the eighth century.

The Coming of Beet-Sugar

In contrast to this classical birth, the coming of beet-sugar was in the hands of German and French chemists and technicians. It was a very different Germany from to-day which saw Andreas Sigismund Marggraf, of Berlin University, two centuries ago apply his inspired chemistry to a variety of interesting problems. Marggraf is chiefly remembered for his work on phosphorus, on potash and soda. He was a *savant* untouched by political troubles, his only grumble being against the number of quack chemists of his time: "The physician, the statesman, the financier, the barber and the army surgeon, the brewer and the brandy-maker, the dyer, the tanner, the wise woman, the charcoal-maker and the wood-cutter; yea, even the company promoter (O, what a sorry label!) are brazen enough to count themselves among the chemists." We can forgive Marggraf his exaggeration, for he claimed little credit as the man who discovered in the beet a sugar "similar in properties" to cane-sugar. He only obtained 3 per cent. by extraction, but he was the first in the field.

Even less acclaimed in connection with beet-sugar is the name of Martin Heinrich Klaproth, German chemist and pharmacist, who as a boy earned his schooling by singing in the church choir; who became apprenticed in Wendland's famous pharmacy "at the sign of the Golden Angel in the street of the Moors". Klaproth was probably so engrossed in his analysis of more than 200 minerals, in becoming the greatest analyst of his time, that he had little time to win a fortune by applying his work on sugar-beet to large-scale practice.

The First Sugar Factory

So it was left to Achard, one of Marggraf's pupils, to launch the venture on a large scale. He roused the interest of King Frederick William III of Prussia, and was granted an estate at Kunern, Silesia, where the new factory was built and a school of sugar technology eventually founded for training men in the practice. At first he could produce only 6 tons of sugar per annum, costing 2s. 4d. per lb., but he had set the snowball rolling, and soon the French and German chemists were out for improvements. Achard of Kunern! The name is almost forgotten of this pioneer who published those classic memoirs on the preparation of sugar-beet and of spirits from beet. He died at Kunern in 1821.

Sugar a Luxury

The high price of sugar from Achard's factory recalls the fact that in England also it was an expensive commodity for centuries. Indeed, sugar was not only regarded as a luxury but was used chiefly as a medicine at first, a usage introduced by Persian physicians. "Like an apothecary without sugar", was an old

proverb with much point in it. English cane-sugar, used for making marzipan and expensive sweetmeats as well as medicine, came from the East and had to pass through the staple at Venice—" the staple at Venys thorowt Almaigne by marte into Flaunders "—before reaching this country, being bartered for wool—a source of wealth in those days. Sugar consumption increased as the habit of tea-drinking spread, yet the product met with powerful criticism at one period. It was condemned by some doctors because of its reputed strong " acescence " and because it caused teeth decay, " scurvy, consumption and other Distempers "!—a charge possibly due to the dermatitis among those handling raw sugar, a disease still met with in the old-fashioned candied fruit factories in the Near East. So, in any history of sugar, one must include that great defender of sugar, Frederick Slare, who, in his *Vindication of Sugars against the Charge of Dr. Willis, other Physicians and Common prejudices* of 1715, argued that far from aggravating acidity it relieved it; that sugar was " pleasant, soft and balmy "; and

> *That which preserves Apples and Plumbs,*
> *Will also preserve Liver and Lungs.*

And did not the great Duke of Beaufort die with all his teeth good and with the viscera of a man of twenty, despite his pound of sugar per day?

Commercial Production in France

In France, with no sugar controversies, the cutting off of cane-sugar supplies drove up the price and led the Government of 1806 to offer the first bounty on the production of beet-sugar. In 1811 Napoleon had 70,000 acres of beet planted, while on the estate of Crespel-Delisse at Lille the first factory was built. A year later th French Government appropriated a million francs for the completion of experiments on the commercial production of beet-sugar. Soon, forty small factories were in operation, giving over 1,600 tons of sugar from a crop of 98,000 tons of roots. But when the blockade was relaxed many were closed down, and, despite further Government inducements, Germany took the lead because of her pre-eminence in scientific and technical studies of improved beet crops and sugar produced therefrom. Vilmorin in the France of 1830 had shown the way towards improved breeding of beet; Rabbethge and Gieseche, in a quieter Magdeburg than now, went further in the field. By 1885 the Germans were getting 12 per cent. extraction, the French only 7·8, so that France imported seed from the leading state producing over a million tons of beet-sugar. This century saw the German extraction rise to nearly 16 per cent., the tonnage to 2¼ millions of sugar, and the consumption per head of population to over 40 lbs.

Secrets of Sugar Refining

In line with this struggle towards perfection, technicians of all nations were concerned with a greater one—that is, of refining, an operation for long a close secret of Venice. Sugar had been made entirely in open pans or " evaporating coppers ", heated at the bottom to cause much caramelisation and burning at the side. When false bottoms and steam coils came, the steam was at such a low pressure that it proved difficult to keep the syrup boiling—hence the many ingenious devices to trap at least a little of the heat losses from the flues. Wood ashes had long been used for purifying sugar, *vide* Marco Polo, who stated that the Egyptians introduced such a process into China. Even as late as the middle of the nineteenth century one hears of such crude methods as the addition of a bucket of bullock's blood to the sugar " blow-up " to coagulate and collect impurities as a scum! The whole history of sugar refining in the eighteenth century was one of perpetual squabbles, as each section asked the Government for some preferential treatment and made battle generally with the West Indian refiners. As for the names of the men who should go down in refining history, they are many: Howard, who in 1813 took out a patent for the use of a vacuum for concentrating; Pecqueur and Rillieux, for the multiple-effect evaporator; Figuier, who brought in bone char and put it to test at Orleans; Penzoldt, interested in wool drying and thus inventor of the centrifuge; and Henry Bessemer, one-time engraver of labels, who found time from his studies of steel to think of the suspended centrifugal, later improved by Weston.

Forgotten Pioneers

The whole history of sugar teems with such men, many of whose names have been forgotten. To the general public, brought in these days to value sugar but never to realise the effort needed to ensure its purity and whiteness, nothing is known concerning these men, who, in their struggles, were just as much crusaders as those Soldiers of the Cross returning with wonderful accounts of the sweet substance they had sampled in Syria, Arabia and Palestine.

Recent Developments of the Resazurin Test

(*Continued from page* 311)

analogy we may instance the method of measuring the temperature of water flowing in a pipe and getting steadily hotter. A small thin-walled thermometer may be taken as a model of an electrode of noble metal of negligible poising power, a large thick-walled thermometer as a model of an Eh dye in the milk, and the rise in temperature of the water as a model of the fall in potential of the milk. Neither thermometer will give *quite* accurately the temperature of the water, but the small thermometer will do so accurately enough for all ordinary purposes. The temperature recorded by the large thick-walled thermometer will always have a lag behind the true temperature, and will be incapable of revealing quick fluctuations in temperature. The lag is due to the absorption of heat by the thermometer itself. Similarly, the lag suffered by the dye may be considered as due to the absorption of reducing substances, and the size of thermometer forms a convenient analogy to the concentration of the dye.

The concluding instalment of " The Recent Developments of the Resazurin Test " will be published in the next issue and will contain a full list of references to the literature.

The Pasteurisation of Milk

NO SUBJECT of medical and agricultural interest has aroused more discussion than the proposal compulsorily to pasteurise all milk, and it is unfortunate that discussion, which is usually useful, has often been distorted to arguments lacking the foundation of fact and expressing sheer prejudice, which are not only useless but serve to confuse the issue and retard the progress of the dairy industry.

Professor Wilson's book* is frankly propaganda, but honest and sensible propaganda. He has been criticised for going beyond his original terms of reference, which were " to undertake the collation and review of the existing evidence on the whole subject of pasteurisation and the safety of milk supplies " (page v). As the book now appears independently of the Ministry of Health and has in fact " been brought up to date and suitably modified " (page vi), we may accept this extension without dispute and regard the book as the expression of the author's views on the subject and quite independent of any official ones. Not only has every scientific investigator the right to publish his findings and express his conclusions as to how policy should be shaped and legislation created, but he would be failing in his duty to the community if he did not do so. Professor Wilson's book is therefore welcomed for two reasons—as a review of existing evidence and as an expression of the views of one of our leading authorities on the subject.

The question which may occur to the reader is—For whom is the book written? In some places the matter is reminiscent of a talk to senior school children, such as the discussion of the action of rennet on milk (page 104), and in other places a considerable knowledge is assumed—*e.g.*, by references to " Lancefield Group A " streptococci and other technical terms which will be known only to the specialist. This fact, and the frequent repetition of the same matter, reveal the dual nature of the book, and can undoubtedly be ascribed to the method by which it has come into being.

Sale of Dangerous Milk

Some statements and their implications are not always correct. For example, on page 4 it is said that :

> " The fact that a great deal of raw potentially dangerous milk is being retailed in this country at the present time, and that in several districts a supply of safe milk is unobtainable, has a prejudicial effect on the total amount consumed."

The reviewer cannot agree with this statement. It is his experience that people pay more attention to crossing a street than they do to their milk supply. Further, what sane man argues " this milk is teeming with dangerous germs—therefore I will only drink half a pint instead of a pint "? A person intelligent enough to realise the danger will obviously be capable of boiling the milk. Nor must we overlook the fact that for every case of the consumption of milk leading to a definite case of disease there are millions of cases where no harm is suffered, and the average man is prepared to risk such chances in the same way that he travels by train or motor-car. The writer has been struck by the way in which educated people in country houses will feed young children on raw milk from one or a few cows kept on the premises, which is easily the most dangerous way of taking raw milk, unless the cow is most carefully tested. The chief factors controlling consumption are price and custom.

The section on mastitis (page 9) paints a rather unfair picture. Probably not more than 50 per cent. of cows, including those very lightly infected, excrete mastitis organisms. Line 4, second paragraph, should read " *have* suffered from it to some extent ". It is generally accepted now that complete recovery can occur quite spontaneously.

Bacteriological Considerations

Str. agalactiæ cannot be described as a hæmolytic streptococcus, fully half the infections being due to the non-hæmolytic variety. Moreover, Minett's Groups II and III are non-hæmolytic, so that mastitis streptococci cannot be referred to loosely as " hæmolytic streptococci ".

The reference on page 16 to 3 gallons as the average milk yield per cow per day suggests that Professor Wilson might have got a wider circle of friendly critics to read the manuscript; it is doubtful if it is as high as 1½ gallons.

The question as to whether specific bacteria are responsible for specific diseases is touched upon on page 20, and Professor Wilson may be reminded that some members of the medical profession, as well as the laity and the non-medical scientific professions, still hold these views, and in fact are often the most bitter opponents of pasteurisation.

The second method for estimating the number of deaths due to bovine T.B. devised by Professor Wilson is interesting, but it is an optimistic claim to assert (for London) that " practically all cases of non-pulmonary tuberculosis must be infected with the human type " and " in London where there is no longer any source of bovine infection " (page 28). If *all* the milk were *properly* pasteurised this might be a reasonable claim; this point in fact strengthens Professor Wilson's argument.

Clotting of Milk

There are a few chemical inaccuracies. Thus lactalbumin is stated to clot (page 79), vitamin A to be a yellow oil (page 82), and casein to form 85 per cent. of the total protein of cows' milk (page 87).

The discussion of rennet action (page 104) makes no reference to the work of Berridge, who has shown that the clotting occurs in two stages which can be separated, the first enzymic change proceeding slowly at 0° C., and the second (non-enzymic) being the denaturation and precipitation of the protein, the reaction having the usual high temperature coefficient and being sensitive to cations such as those of calcium.

* *The Pasteurisation of Milk.* G. S. Wilson, M.D., F.R.C.P., D.P.H. London, 1942. Pp. 212+xii. 18s.

The characteristic " cow flavour " of freshly drawn milk is not due to " contamination with manure " (page 98). It can be removed by heating and aeration, but not so well by filtration.

The question of the more rapid growth of bacteria in pasteurised milk than in raw (page 96) is not adequately dealt with. Lactic acid bacteria will grow faster in heated milk, and starter sometimes works faster in pasteurised milk on account of the removal of inhibitory flora. Certain types such as *B. mycoides* will also grow faster in pasteurised milk, and so this treatment may accelerate *sweet curdling*.

The discussion of heat destruction of hæmolytic streptococci (page 147) includes no mention of *Str. durans*, and the reference to " articles containing added carbohydrate " (page 170) gives the impression that staphylococci produce toxin most readily from this carbohydrate.

Keeping Quality

The important subject of keeping quality receives only very scant treatment—6 lines on page 106! As a medical man, Professor Wilson is naturally interested in the public health aspects, but the commercial aspects deserve far more attention. It is probably true to say that milk is pasteurised primarily to improve its keeping quality. Indeed, cities like London could not be supplied with milk satisfactorily if it had to be delivered raw. The author would have greatly strengthened his case if he had expanded on this important aspect. One would have liked him to give his opinions on the different types of pasteurisation, particularly the *in-bottle* type, which is obviously the most satisfying to the bacteriologist. Provan and Rowlands have drawn attention to the superior keeping quality of this type of milk, and Davis, Twigg and Wright have shown that ordinary commercial raw milk, if laboratory pasteurised, will keep for weeks at refrigeration temperatures. The point here is that ordinary commercially pasteurised milk is always contaminated before or in bottling, even in the best depôts, and in the worst cases the so-called pasteurised milk is worse (poorer keeping quality) than the raw. The reviewer still regularly hears of complaints that pasteurised milk will not keep overnight. This cannot be regarded as a satisfactory state of affairs. Both *raw* milk and *inefficiently pasteurised* milk are problems of considerable importance.

Feeding Experiments

A considerable part of the book (in the reviewer's opinion the best part) is devoted to a critical discussion of feeding experiments on rats, mice, calves and children. As the author points out, no really satisfactory experiment on children has ever been carried out. These experiments are undoubtedly of the greatest scientific interest, but the man-in-the-street may be forgiven for asking under what circumstances human beings are likely to live on a diet of milk and copper, iron and manganese salts. Since the only time that human beings live on an unsupplemented diet of milk is for the first nine months or so, it is unlikely that a really satisfactory experiment will ever be carried out.

We may accept Professor Wilson's summary of the destructive losses incurred by pasteurisation as limited to 10 to 25 per cent. of the vitamin B_1, 20 per cent. of the iodine, and 5 to 50 per cent. of the vitamin C, the last being chiefly controlled by exposure to light, and copper and oxygen content, as shown by Kon and others. For all human beings other than young babies these losses are not of practical importance since we do not rely on milk as a source of these substances. Milk for babies can be suitably supplemented, and there is a case for maintaining a special supply of high-grade T.T. milk which can be made available for infant feeding if required. It is true that no one has ever proved that some unknown labile factors are *not* destroyed by pasteurisation, but no one has yet proved that such factors exist; the overwhelming probability is that no such factor does exist.

Arguments against Pasteurisation

The last part of the book is devoted to a discussion of the arguments against pasteurisation. Professor Wilson deals very fairly with these, and as they have been discussed *ad nauseam* elsewhere it would serve no purpose to go into them here.

The whole question of pasteurisation from the scientific viewpoint may be summarised as follows:

1. Is raw milk a menace?
2. Does pasteurisation remove the menace?
3. Does pasteurisation significantly affect the nutritive value of milk in relation to the rest of our diet?

A fourth question of commercial interest is: Is pasteurisation worth while commercially?

It is obvious that only persons who are trained in bacteriology and biochemistry and have made a special study of milk are competent to answer these questions. It is unfortunate that others so frequently attempt to answer them. The case for pasteurisation on paper is overwhelming. Were there a proposal to attempt to *sterilise* all milk there might be a case against it, but there is no adequate case against pasteurisation.

Control of Supplies

Professor Wilson would probably agree with the reviewer that a minimum compulsory control of the milk supply is essential and should be undertaken immediately. Why should more attention be paid to water than to milk? There is little doubt that a satisfactory solution to the problem could be evolved at once if the best informed opinion on all sides could be co-ordinated and given the necessary power.

The reviewer suggests the following:

1. Compulsory pasteurisation of all milk other than T.T. milk of a certain hygienic quality. Such proposals are sometimes limited to towns of above a certain population. Why should rural workers be denied the advantages of a safe milk supply? Are their lives less valuable than those of the urban dweller?
2. Proper control of all dairies and creameries pasteurising milk by *adequately trained personnel*.
3. Regular testing of all supplies, both raw and pasteurised.
4. Quality payment.

Co-operative Measures

Considerable improvement could be affected by co-operative measures without destroying the individualistic aspect—*e.g.*, the family unit as a milk producer. Thus all producers could send their milk immediately

after production to a central collecting depôt, which could be the best equipped farm in each parish, where the milk could be adequately cooled—*e.g.*, to 50° F. Farm refrigeration is not economically possible, but cooling at a centre is, and this would also greatly simplify and expedite collection. Transport is still one of the biggest problems in the industry, and such a measure would greatly expedite creamery collections.

This measure, coupled with reasonable care in production and efficient cooling at all collecting depôts—*e.g.*, to 35° F.—would result in the complete elimination of all troubles due to sours, both between farm and depôt and distributing centre.

Summing up, it may be said that the book serves a most useful purpose, especially as it covers a field which is very inadequately served by books in this country. It can be strongly recommended to all interested in this important subject.

JOHN G. DAVIS.

The Analysis of Food and Drugs

THE call in wartime for a sixth edition of this handy little volume* is evidence of its popularity, and, although only eight years have passed since the last appeared, Dr. Nicholls has found it advisable to increase the size of the volume by yet another 100 pages. In the preface the author stresses the fact that it is intended for use in laboratories and not for students to use as a cram book. Accordingly, the amount of space devoted to various items is proportional to their relative importance from the analytical standpoint rather than to the amount of scientific knowledge available, which is as it should be. Much of the information included is not to be found readily elsewhere, as, for example, the detection of attempts to remove markings on eggs. In the last edition the bibliography has been considerably increased, and this has now been so expanded, both with references, chiefly to the *Analyst*, and with legal notes, that it is doubtful whether any other volume contains so much accurate information in these directions.

The skill with which Dr. Nicholls attempts to deal with wartime legislation is something at which one can but marvel. Most of what is necessary or is likely to become permanently useful is included, but he carefully refrains from advertising the amount of meat in what we now call sausages. The book is such a mine of information that it would be impossible to review it in a short space with anything like adequacy, and one can only say that no food laboratory can afford to be without it. Any apparent criticism must therefore not be taken to represent the view that one does not appreciate the work, but rather as an attempt to indicate one or two points where the reviewer is not quite in agreement with the author. Artificial vinegar is usually sold as "Non-Brewed" and seldom, if ever, as "Imitation". With regard to the test for methyl alcohol in spirits, the reviewer prefers the chromotropic acid reaction to that with magenta, as it is simpler to carry out and gives a more definite result; and it would be an advantage if page numbers could be included with cross-references in a future edition in order to save time. Printers' and reference errors appear to be entirely absent, and both author and compositor are to be congratulated on this most important detail.

T. McL.

* *Aids to the Analysis of Food and Drugs.* Sixth Edition. J. R. Nicholls, D.Sc.(Lond.), F.I.C. Pp. vii+424. 10s.

Food Control—Its Public Health Aspects

THE title of this book* should not be misunderstood. It refers not to what we know as war-time regulation of supplies but to the inspectorial and analytical, including bacteriological, control of food to see that it conforms to good standards. The materials discussed include milk (production, certification, and pasteurisation), butter, cheese, concentrated milks, other dairy products, meat, poultry, eggs, cereals, bakery products, and breakfast foods, fresh fruits and vegetables, preserved foods, and a usefully large number of fish and crustaceans. There is also a luscious chapter on ice cream. Each chapter or section discusses technology (the various modes of preparation of the material), control measures, and relation to public health. Within this framework are discussed such matters as inspection, nutritional values, spoilage and adulteration; and suggestions for the tracing of contaminations are given; as well as some brief histories of outbreaks of poisoning due to various causes. Useful tables of composition are given for each food. The author was formerly Director of the Bureau of Chemistry and Food of the Baltimore Health Department, and is now Instructor in Biochemistry at the celebrated Johns Hopkins University. While not a medical man, he keeps the public health aspect well to the fore in this book so that it amply justifies its title.

The information is necessarily condensed, but there is a great deal of it. The index is good.

The book can be cordially recommended to the analyst and public health worker concerned with food, and on account of the treatment of technology it will also be useful to food manufacturers. To all of these the book will serve as a handy guide and *multum in parvo*.

H. N.

* *Food Control: Its Public Health Aspects.* By James Houston Shrader. Pp. x+513. London. 1939. 24s. net.

British Material for Export

Overseas readers are advised that the fact that goods made of raw materials in short supply owing to war conditions are advertised in FOOD MANUFACTURE should not be taken as an indication that they are necessarily available for export.

Ministry of Food

Latest Statutory Rules and Orders

The list given below is the continuation of the list of Orders published in *Food Manufacture*, October 1, page 294.

No.	*Date.* 1942.	PRICE FIXATION ORDERS
1017	May 27.	Amending the Cereal Breakfast Foods (Control and Maximum Prices) Order, 1941.
1021	,, 28.	Amending the Egg Products (Control and Maximum Prices) Order, 1942.
1053	June 1.	Amending the Home-Grown Tomatoes (Maximum Prices) Order, 1942.
1086	,, 4.	Amending the Eggs (Control and Prices) (Northern Ireland) (No. 3) Order, 1941.
1087	,, 4.	Amending the Oats (Control and Maximum Prices) Order, 1941, and the Oats (Control and Maximum Prices) (Northern Ireland) Order, 1941.
1093	,, 5.	Amending the Home-Grown Cucumbers (Maximum Prices) Order, 1942.
1094	,, 6.	Carrots (1941 Crop) (Maximum Prices) Order.
1106	,, 8.	Amending the Saccharin (Control and Maximum Prices) Order, 1941.
1137	,, 12.	Cherries (Maximum Prices) Order.
1138	,, 12.	Soft Fruits (Maximum Prices) Order. Revokes S.R. & O. 1941 Nos. 607, 816, 817, 1240, 1278 and 1518, and 1942 No. 080 as respects Soft Fruits, and the Directions contained in 1942 No. 1105.
1191	,, 19.	Hay (Control and Maximum Prices) Order. Revokes S.R. & O. 1941 Nos. 350 and 1147 and 1942 No. 358.
1192	,, 19.	Hay (Maximum Prices) (Northern Ireland) Order. Revokes S.R. & O. 1941 No. 1145 and 1942 No. 359.
1212	,, 23.	Amending the Meat (Maximum Retail Prices) Order, 1940.
1219	,, 24.	Amending the Feeding Stuffs (Maximum Prices) Order, 1941.
1259	,, 27.	Amending the Soft Fruits (Maximum Prices) Order, 1942, and granting a General Licence thereunder, and under the Cherries (Maximum Prices) Order, 1942.
1207	July 2.	Directions under the Flour (Control and Prices) Order, 1941.
1208	,, 2.	Carrots (1942 Crop) (Maximum Prices) Order. *See* 1499 below.
1307	,, 4.	Amending the Lard (Maximum Prices) Order, 1940.
1354	,, 9.	Barley (Control and Maximum Prices) (Great Britain) Order, 1942. Revokes S.R. & O. 1941 Nos. 1202, 1576 and 1793* and 1942* No. 474.
1355	,, 9.	Amending the Barley (Control and Maximum Prices) (Northern Ireland) Order, 1941. *See* 1551 below.
1363	,, 10.	General Licence made under the Bread (Control and Maximum Prices) Order, 1941.
1380	,, 13.	Plums (Maximum Prices) Order.
1381	,, 13.	Meat Products and Cooked Meat (Control and Maximum Prices) Order.
1387	,, 14.	Amending the Cherries (Maximum Prices) Order, 1942.
1392	,, 15.	Home-Grown Rye (Control and Maximum Prices) (Great Britain) Order, 1942. Revokes S.R. & O. 1941 Nos. 1308 and 1793* and 1942 No. 474*.
1393	,, 15.	Amending the Home-Grown Rye (Control and Maximum Prices) Order, 1940.
1394	,, 15.	Amending the New Potatoes (1942 Crop) (Control and Prices) Order, 1942. *See* 1498 below.
1396	,, 15.	Amending the Retail Prices (Notices) Order, 1942. (Soft Drinks.)
		GENERAL
937	May 18.	Amending the Food (Restriction on Dealings) Order, 1941. Prescribing an Appointed Day and granting General Licences thereunder.
948	,, 20.	Direrctions made under the Food Transport Order, 1941. (Tomatoes.)
977	,, 22.	Directions made under the Food Transport Order, 1941. (Oatmeal, etc.)
1013	,, 26.	Chicory (Control) Order.
1055	June 1.	Amending the Directions, January 6, 1940, given under the Rationing Order, 1939, and amending the Cheese (Rationing) Order, 1941.
1095	,, 6.	Prescribing an Appointed Day for the purposes of the Food (Restriction on Dealings) Order, 1941. (Chocolate and Chocolate Confectionery and Sugar Confectionery.)
1125	,, 11.	Amending the Food (Conditions of Sale) Order, 1940.
1194	,, 19.	General Licence (Eggs).
1199	,, 20.	Amending the Sampling of Food Order, 1942.
1265	,, 29.	Amending the Directions, April 4, 1942, under the Rationing Order, 1939, and the Preserves (Rationing) Order, 1941.
1336	July 7.	Soft Drinks (Current Prices) Order.
1337	,, 7.	Soft Drinks (Licensing and Control) Order.

* Part only revoked.

News from the Industry

Control of Tins, etc.

An additional series of regulations designed to reduce the country's consumption of tin became operative on September 25, under the Control of Tins, Cans, Kegs, Drums and Packaging Pails (No. 8) Order, 1942, being a further supplement of the existing No. 5 Order.

Further restrictions are imposed upon the manufacture from tinplate of whole or certain parts of containers used for the distribution on the home market of a number of commodities, including some foodstuffs. They have, however, been designed to ensure that adequate protection of the product packed can be obtained by the use of containers made from steel, coated not with tin, but with a protective lacquer or varnish which are still permitted under the terms of the Order.

* * *

Insurance of Stocks and Equipment

The Board of Trade have reason to believe that a number of traders and firms who are required to insure their stocks or equipment under Part II of the War Risks Insurance Act, 1939, or Part II of the War Damage Act, 1941, as the case may be, are failing to comply with their statutory obligations by either not insuring at all or insuring for a sum considerably short of the full value for which the law requires them to insure.

A number of prosecutions have recently been instituted by the Board against persons who have failed to comply with their obligations, and traders are warned that the Board will not hesitate to enforce the provisions in question wherever necessary.

* * *

Sir Charles Tegart

Sir Charles Tegart, former Police Commissioner in Calcutta, has been appointed by the Food Ministry to work with Scotland Yard and the Ministry's enforcement officers in fighting black market men. He has started work from H.Q. at Colwyn Bay.

Manufactured and Pre-Packed Foods

The Manufactured and Pre-Packed Foods (Control) Order, 1942 (Statutory Rules and Orders, 1942, No. 1863), has for its chief object the obtainment of full information about a wide range of food manufacturing and pre-packing operations over which there has hitherto been no control. "'Pre-packing' in relation to any food means the packing thereof (otherwise than by a retailer for the purposes of retail sale by him on the premises on which the food is so packed) in advance ready for retail sale in a wrapper or container, but does not include the canning of any food; and 'pre-packed' shall be construed accordingly." The information supplied by the firms concerned will enable the Ministry of Food to take any further action that may be needed to keep up an adequate supply of those manufactured foods which, although small in volume, are essential. A large list of foods to which the provisions of the Order do not apply is given in the first, second, third and fourth schedules.

* * *

New Food Control Committees

The Minister of Food has introduced a new Order by which all existing food control committees will be dissolved on December 31, and new committees appointed on January 1 for one year. Casual vacancies will be filled as they arise, and any member will be eligible for appointment for the following year.

Some of the qualifications for membership have been broadened, caterers and shop assistants now being eligible as trade members. Any person will be eligible as a consumer member who is not in any way connected with food business and who is not regularly employed by the Ministry. The committee and all sub-committees must contain a majority of consumer members.

The Order took effect on September 14.

U.S. Food Advisory Committee

The appointment is announced of Mr. John T. Menzies to serve on the Food Advisory Committee which deals with America's food supply. Mr. Menzies, who is British born, is president of the Crosse and Blackwell Company of Baltimore—an associate company of Crosse and Blackwell, Ltd., London.

* * *

Continuation of Sugar Agreement

The International Sugar Agreement, signed in London on May 6, 1937, was to remain in force for a period of five years, ending August 31, 1942. A protocol continuing the agreement in force for two years from August 31, 1942, has been signed by representatives of the following Governments:

South Africa.
Australia.
Belgium.
Brazil.
Cuba.
Czecho-Slovakia.
Dominican Republic.
Haiti.
Netherlands.
Peru.
Portugal.
Union of Soviet Socialist Republics.
United Kingdom.
United States of America (and Commonwealth of the Philippines).

* * *

Three New Drying Plants

Three Government-sponsored factories for drying vegetables are to be set up in England, it was reported at a recent meeting of the National Farmers Union. They will be situated in Cornwall, Shropshire and Norfolk, and will also be able to dry milk. One will dry cabbages and the other will make soup powder from dried carrots, potatoes and steak.

The establishment of drying works in Cornwall will help to solve the problem of disposing of any surplus spring cabbage. Farmers in that area had to let much of the crop rot early this year for lack of a market. The Ministry of Food has already offered growers contracts for next season.

Macaroni

An Order which came into force on October 11 provides that except under licence no person may manufacture for sale or pre-pack macaroni and similar products.

* * *

Rice Supplies

Owing to the short supply of rice, the Ministry of Food has prohibited the use of pure rice starch for laundries and household purposes. A national blended starch is being manufactured to replace it.

* * *

Use of Semolina

An Order was made by the Minister of Food prohibiting the use of semolina after October 17 as an ingredient in any manufactured product containing meat or in any "meat or fish paste" as defined in the Meat Products and Cooked Meat (Control and Maximum Prices) Order, 1942; and after November 14 as a dusting material in the production of bread, which expression does not include fruit loaves or bun loaves.

The purpose is to conserve wheat, and bakers will be encouraged to use oatmeal, which is produced from home-grown grain, as a substitute. Bakers should ask their usual suppliers of dusting products for fine-cut oatmeal.

* * *

Oils and Fats for Allies

Britain and America are to become exclusive purchasers of all oils and fats available to the United Nations throughout the world.

This plan now in operation for co-ordinated buying of fats and oils is a part of the general strategy of the combined Food Board, which seeks to make possible the efficient procurement and allocation of the various important food supplies available to the United Nations for the combined war effort.

Under the agreement the United States will be the exclusive purchaser on behalf of the Governments adhering to the agreement of the following: All oilseeds and oils and fats in the North and South American continents, including the Caribbean islands, with the exception of animal fats in Argentina and Uruguay; copra in Tahiti and all Fighting French Pacific islands; all oilseeds and oils and fats in Portuguese Africa, Spanish Africa and Liberia.

The United Kingdom will be the exclusive purchaser of all animal fats in Argentina and Uruguay; all oilseeds and oils and fats in British Empire countries, with the exception of territory specified in the American agreement; all oilseeds and oils and fats in Fighting French Africa; all oilseeds and oils and fats in the Belgian Congo.

About one-third of all United States fats and oils consumption is for non-food uses, chiefly for soap, glycerine for explosives, paints, varnishes, lacquers and other industrial uses.

A restriction on consumption in the U.S. limits the use of various fats and oils to definite percentages and allocates supplies to manufacturers and processors accordingly. With this order in effect it will be possible to build up adequate reserves for meeting such possible future contingencies as further loss of imports, possible crop failure or further increases in Lend-Lease needs.

The U.S. Secretary of Agriculture, Mr. Claude R. Wickard, and the Hon. R. H. Brand, of the British Food Mission, are the joint members of the combined Food Board.

* * *

Photographic Exhibition

An Exhibition of "Photography in Industry and Science", promoted by the Association of Scientific Workers, is being held during November in the rooms of the Royal Photographic Society. It was opened by Sir Robert Watson Watt, F.R.S., under the chairmanship of Mr. D. McMaster (President, R.P.S.) on October 31.

The field covered by the exhibits is wide and has particular reference to the war effort, including work on machine movement analysis, radiography of castings, etc., mapping and surveying, mass examination for tuberculosis, crystallography, astronomy, nuclear physics, template making, etc. Exhibitors include the Ministry of Information, technical branches of the three Services, individual technicians and the large photographic firms.

Dr. Stamp

The Minister of Agriculture has appointed Dr. Dudley Stamp to be his Adviser on Rural Land Utilisation. Dr. Stamp will advise on the agricultural aspects of town and country planning schemes, being peculiarly fitted to this task. He is well known as a geographer, and as Director of the Land Utilisation Survey of Great Britain he has carried out pioneer work that will be invaluable in dealing with planning problems.

In the past little account has been taken of agricultural considerations in planning the utilisation of our limited land resources. Dr. Stamp's appointment is an indication that the position will be different in future.

The Government has already announced that it will "seek to avoid the diversion of a productive agricultural land to other purposes if there is unproductive or less productive land that could reasonably be used for those purposes"—statement made by Lord Reith on February 11, 1942. It is necessary to ensure that no agricultural land is diverted to non-agricultural purposes unless it is clearly in the national interest, and to this end the Ministry of Agriculture will work in close co-operation with the Ministry of Works and Planning.

* * *

Canning News from Canada

The domestic pack of canned fruits in Quebec Province last year is tabulated by the Provincial Bureau of Statistics as follows: Blueberries, 57,910 (10,070) lbs.; strawberries, 31,168 (33,632); raspberries, 21,794 (29,920); apples, 39,060 (23,772); plums, 6,290 (5,100) lbs.; other fruits, 50,920 (31,400) lbs.; jams, 9,810 lbs.; jellies, 2,310 lbs.; marmalades, 705; total for all fruits, 219,969 (146,809) lbs.

The domestic pack of canned meats in Quebec Province last year was almost double that of the previous year, according to the Quebec Bureau of Statistics. The pack amounted to 3,096 cases, compared with 1,625 the previous year. Canned beef amounted to 1,608 cases (as against 759 in 1940); veal, 257 (106); chicken, 626 (288); pork, 445 (409); other meats 160 (63).

The domestic pack of canned vegetables in Quebec Province last year (with the 1940 pack in brackets) is given by the Provincial Bureau of Statistics as follows: Beets, 84,368 (14,976) lbs.; carrots, 77,885 (45,745) lbs.; green beans, 777,810 (547,500) lbs.; baked beans, 82,208 (26,112) lbs.; cream of corn, 492,660 lbs.; corn on cob, 67,470 lbs.; (all corn, 695,196 lbs.); green peas, 187,425 (43,740) lbs.; tomatoes, 9,963,912 (7,183,806) lbs.; tomato juice, 468,576 lbs.; mixed vegetables, 149,190 lbs.; other vegetables, 51,780 (246,300) lbs.; total for all vegetables, 12,352,784 (8,803,375) lbs.

British Columbia's canned salmon pack totalled 406,266 cases at August 8, 1942, compared with 641,555 cases on August 9, 1941, and 445,789 cases at the comparative date of the cycle year 1938.

* * *

New Bakery Trade Directors

As a consequence of the extension of control in the bread, biscuits and cake industries, it has been decided to re-organise the Trade Directorate at the Ministry of Food. Under the general direction of a Director of Bakeries, there will in future be three Trade Directors responsible respectively for bread, cake and flour confectionery, and biscuits.

All the appointments have not yet been made, but the following are announced as coming into immediate effect.

The Minister has appointed Mr. J. N. Frears, at present Director for Bread, to be Director of Bakeries, and Mr. Howard Hughes, at present Director for Cake and Biscuits, to be Deputy-Director of Bakeries.

The new Director for Bread is Mr. A. Grant Lawson, hitherto Deputy Divisional Food Officer at Glasgow, and the new Director for Biscuits is Mr. Herbert Webster, of Messrs. W. and R. Jacobs, Ltd.

No appointment has yet been made to the newly-created post of Director for Cake and Flour Confectionery.

Mr. W. S. Duthie, Director of Emergency Bread Supplies, is not affected by the foregoing re-organisation.

Mr. W. S. Goodfellow, hitherto Principal Area Bread Officer, East of Scotland Food Division, has been appointed Deputy-Director of Emergency Bread Supplies for Scotland, in succession to Mr. Francis Beattie, D.L., J.P., M.P.

* * *

Research on Canned Foods

A research programme for the study of nutrition values of canned foods, developed by a committee representing the National Canners' Association, assisted by scientific advisers both inside and outside the canning industry, has been inaugurated with the placement of financial grants with the University of Arizona and University of Wisconsin. Other grants are expected to be made in the near future. The programme will be financed jointly by the National Canners' Association and the Can Manufacturers' Institute.

The first phase of the programme contemplates the assay of about twenty-five products, including fruits, vegetables and seafoods, for six vitamin factors (A, C, thiamin, riboflavin, niacin, and pantothetic acid), which are regarded as being of established importance in nutrition. Assays will be made also for important minerals. The products to be studied will be taken from all parts of important sections in which they are canned. It is estimated that about 30,000 samples will be taken during the course of this year's programme.

* * *

The Visco Engineering Co., Ltd.

An illustrated leaflet has been published by the Visco Engineering Co., Ltd., in celebration of twenty-one years of progress. The firm was started twenty-one years ago by the present Chairman and Managing Director, Mr. F. Curt Smith. Its express purpose was to place on the English market an all-metal air filter using oil-film-covered surfaces. As time went on other equipment such as water-cooling towers, ventilators and vacuum cleaners began to be manufactured. The leaflet gives an interesting account of the different developments of the firm.

Re-use of Wiping Rags

Supplies of cotton wiping rags used in every kind of manufacturing process for wiping and cleaning purposes have become very scarce, and recently a Ministry of Supply Salvage of Waste Order No. 3 was introduced prohibiting the destruction of these rags after use, which has been the almost universal method of disposing of same.

Saul D. Harrison and Sons have a scheme in operation whereby it is possible to accept the return of oily, greasy, and otherwise used rags for re-washing. For simplification the scheme works on the basis of the supply of washed and sterilised wiping rags at an agreed price, and the re-purchase of the dirty rags also at an agreed price. The greatest benefit to be derived from this scheme, apart from the question of definitely economising on expenditure, is that firms taking advantage of same are more or less assured of future supplies.

* * *

Food from Canada

Mr. Gardiner, the Minister of Agriculture, announced recently in Ottawa an agricultural programme designed to utilise the vast stores of grain now accumulating through record crops, and the increase in the output of animal products for the benefit of the United Nations.

A new agreement will be signed with the British Government committing Canada to supply in the coming year 675,000,000 lbs. of bacon, an increase of 75,000,000 lbs.

There will also be undertaken a programme to encourage the feeding of beef cattle until they are at least three years old, and to increase their number.

Mr. Gardiner said the supplies of grain were now sufficient to permit the planning of a two-year livestock programme.

* * *

Canned Hill Mutton

When the Secretary of State visited the northern counties of Scotland in September he exhibited the first two tins of canned hill mutton. It is hoped that a new canning industry will be established in the Highlands.

Chairman's Finance Talk to Employees

An important move in the direction of stabilising complete confidence between the directors, management and employees has been made by the board of the Brush Electrical Engineering Co., Ltd., and its associate companies, in the form of a meeting held recently, when Sir Ronald Matthews, J.P., the chairman of the company, addressed a large number of representatives from the many departments of the offices and works upon the subject of the company's finance.

During the day the company's annual general meeting had been held, and it was for the purpose of acquainting the company's employees with much that had been discussed at the annual meeting that the meeting of employees was called.

"There is nothing very mysterious," said Sir Ronald, "about the accounts of a public company—they are there for everyone to read who cares to do so. I and my colleagues feel that it is important, and will become increasingly so, that everyone concerned in the business of a company should have a clear picture of what is going on and why it is going on."

Sir Ronald then proceeded to illustrate simply by means of coloured charts how the income of the company was allocated. On one of the charts, a large circle was divided into sections representing the allocation on the basis of percentage. Another, a very enlarged £1 note was coloured to represent the same allocation in cash proportions.

* * *

Concentrated Kitchen Waste

Every month concentrator plants in the London area run by local authorities and private firms turn out over 3,000 tons of treated kitchen waste. The methods of collection and concentration are so efficient that some plants, those run by the Westminster and Camberwell Councils, Edible Extracts, Ltd., of Peckham, and Smithfield Animal Products, Ltd., of Stanwell, near Staines, are reported to find themselves from time to time able to supply new customers. This form of processed kitchen waste gives a sterilised and concentrated feeding stuff for pigs and poultry. It carries no risk of spreading animal disease and makes rationed feeding materials go further. This is a very important point, for, as from September 1, the rations for pigs and poultry are further reduced.

* * *

British Chemical Plant Manufacturers' Association

Because of the continued absence of Mr. Davidson Pratt on Government service, the British Chemical Plant Manufacturers' Association has appointed Mr. Norman Neville to act as Director.

Mr. W. A. Williams continues to serve as Acting Secretary. The address of the Association is as formerly at 166, Piccadilly, London, W. 1.

* * *

India Wheat Forecast

The final estimate of the 1941-42 All-India wheat crop, issued by the Department of Commercial Intelligence and Statistics, is 33,979,000 acres, a decrease of 2·5 per cent. on last year's revised estimate of 34,849,000 acres, and 10,070,000 tons, an increase of 0·4 per cent. on last year's revised estimate of 10,027,000 tons.

* * *

Tomato Growing in the Isle of Wight

As a result of a suggestion made by Captain Hubert Beaumont, M.P., Parliamentary Private Secretary to Mr. Tom Williams, Joint Parliamentary Secretary to the Ministry of Agriculture, tomato growing has been developed on a commercial scale in the Isle of Wight, and between 3,000,000 and 4,000,000 lbs. of tomatoes have been produced this season.

Many developments are under consideration, including the establishment of a canning factory and the growing of fruit and vegetables to supply it.

* * *

Change of Address

Richard Brandt have recently moved to larger premises at 220-224, Pentonville Road, King's Cross, N. 1. Telephone: Terminus 6371-2.

Borough Polytechnic Jubilee

An interesting brochure has been issued in connection with the jubilee of the Borough Polytechnic, which was opened on September 30, 1892, by the Rt. Hon. The Earl of Rosebery, first Chairman of the London County Council. It was one of the three institutes established by the South London Polytechnic Council. The original scheme declared that the object of the Institute is the promotion of industrial skill, general knowledge, health and well-being of young men and women belonging to the poorer classes by instruction in the general rules, principles, and practical application thereof in any handicraft, trade or business, and a varied programme which included public lectures and facilities for physical exercises.

The Polytechnic was an immediate success. In 1894 a Domestic Economy School for Girls and in 1897 a Technical School for Boys were opened.

The Polytechnic owes its inception, endowment and much of its continued maintenance to the Trustees of the City Parochial Foundation, to the London County Council for its annual grant and its special grants towards building extensions and equipment, to the National Association of Master Bakers, to the London Master Bakers' Protection Society, to the Trustees of the Herold's Foundation, of St. Mary Newington and and of the St. Olave and St. John Foundation, to the Worshipful Company of Ironmongers and others.

The number of students and members has grown steadily decade by decade until they are now normally over 6,000 a year.

* * *

Canada's Crop Prospects

Prospects are stated to be "glowing" for an abundant crop of wheat in Canada this season.

Deliveries of "old wheat"—carry-over from the previous harvest—have been appreciably increasing from farms in the prairie provinces. The incitement of an official price of 90 cents (about 4s.) a bushel for the approaching crop means that farm holdings of old surplus grain are being reduced to a minimum.—*Reuter.*

New Produce Federation

The various London commodity and produce trading associations, which recently have been holding meetings to discuss post-war trading conditions, propose to form a federation of commodity associations.

Discussions are continuing and progress is being made, but no final arrangements have as yet been settled.

It is proposed to call the new body, when formed, the Produce and Allied Trades Federation.

* * *

Dried Milk for Britain

California expects to produce 80,000,000 lbs. of dried milk during the current year.

Mr. Robert Jones, of the *Pacific Dairy Review*, after conferring with the director of the American Dried Milk Institute in Chicago concerning increased shipment to Britain, stated that dried milk was helping to solve the problem of feeding Britain, despite the U-boats. British trade pacts are expected to result in the commodity reaching the British Isles in tremendous volume.

* * *

Tea for the Workers

A handsome illustrated booklet dealing with the problem of mid-shift refreshment in different types of industry contains all that is needed to be studied in planning a bulk tea service in factories. The main aim of any tea scheme is speed, economy, quality—*i.e.*, to get ample supplies of good tea to the workers without loss of working time. The initial planning is well set out in all its aspects. Details of equipment, with illustrations, are given.

Mobile service by means of trolleys is dealt with, and a typical trolley service in an actual factory is described. The whole booklet, which is published by the Empire Tea Bureau, is an excellent example of clear exposition. The bureau placed its services at the disposal of the various Government Departments and industry generally, and its staff has been responsible for organising the refreshment service during "breaks" in over a hundred works engaged on war production.

Institute of Chemistry

The Annual General Meeting of the London and South-Eastern Counties Section of the Institute of Chemistry will be held on November 18. To accord with Section Rule 5, the following members of Committee retire and are not eligible for re-election

Fellows: Dr. D. C. Garratt, Mr. R. L. Kenny, Dr. E. A. Rudge. Associate: Mr. A. W. H. Upton.

Officers due to retire under Section Rule 3 are:

Chairman: Dr. J. R. Nicholls. Vice-Chairman: Dr. J. Grant.

After the business of the meeting is finished Dr. J. R. Nicholls, F.I.C., will give an address on "Adulteration Past and Present".

* * *

U.S. Food for Britain

Nearly 600,000,000 lbs. of foodstuffs and other farm commodities from the U.S. were delivered during July for shipment to the Allied Nations, according to the U.S. Department of Agriculture, in a statement quoted by Reuter.

The Allies' chief food requests continue to be for grain and cereal products; the second largest group is meat and fish.

* * *

Stabilising Agents

The raw material used by the manufacturers in the production of Gelozone is coming along somewhat better this season, and they hope to be able to maintain adequate supplies to regular users, and later on may be in a position to entertain new business. This stabilising agent is now so well established among food manufacturers that there must be few firms who are not acquainted with it.

Apart from food manufacture, a special grade has been used in the ice cream industry for some years, and has been looked upon as a standard stabiliser, but as the manufacture of ice cream is now prohibited, more Gelozone will be available for other purposes, consequently those firms who have previously been unable to obtain supplies should again approach the makers.

Messrs. Whiffen and Sons, Ltd., the makers, have for many years been also well known as distillers of essential oil of cloves.

Design for Economy

"Paper in Battledress" described the exhibition, sponsored by the Waste Paper Recovery Association, which was installed in the ballroom of the Savoy Hotel for three days in October.

Hundreds of examples showing how stores, manufacturers, banks, Government departments and other institutions have effected economies in the use of paper were displayed. More than 200 firms and institutions made contributions.

The Borough of Hammersmith Electricity Department showed how it caused the same envelope to make three journeys without the use of any extra paper, while the Gas Light and Coke Company demonstrated how the same envelope does 32 jobs before it goes to war as salvage.

Many ideas were put forward by the War Office, H.M. Stationery Office, the General Post Office, Ministry of Food, the L.M.S. Railway, London Passenger Transport, Kodak, Ford's, Boots, Hoover's, the Imperial Tobacco Company, many of the great London stores, and publishers of magazines and trade papers.

* * *

Edible Gelatine

Prior to the outbreak of war the majority of the edible gelatine used in this country was imported from Belgium and France, who for many years have enjoyed almost a monopoly in the manufacture of ossein, the raw material chiefly used in the manufacture of high-grade edible gelatines complying with the stringent requirements of the Food and Drugs Act.

The preparation of ossein requires great care if a good quality gelatine is to be produced, and the dicalcium phosphate produced in this part of the process, if carefully made, complies with pure food requirements, and is used for self-raising flours, baking powders, bread, etc.

The Cleveland Product Co., Ltd., as the result of many years of research and experiment, are now producing, from British Empire raw material, ossein gelatine, which compares favourably with the best Continental manufacture.

British Sugar Corporation

Lieut.-Colonel Sir Francis Humphrys presided at the sixth annual ordinary meeting of the British Sugar Corporation on September 15, and, in the course of his address, said that the decision of the Government to which he referred last year, to alter temporarily its financial relations with the Corporation as laid down in the Sugar Act of 1936, had been finally carried into effect by the passing of the Sugar Industry Act of 1942, "the provisions of which will remain in force during the war period only. The directors are confident that the interests of the shareholders have been safeguarded by these new arrangements, which are working smoothly.

The "reasonable rate" of interest on the Corporation's issued capital has again been fixed by the Treasury at 3½ per cent., and allowance has been made in the deficiency payment for depreciation, debenture interest, staff pension fund, research and education and interest on the Corporation's reserves employed in the business.

The Corporation's share of the economies under the profit-sharing scheme amounted to £75,443.

After deducting head office and other general charges (£93,916) and depreciation as ordered by the Minister (£201,000) from the profit of £578,864, there remains a sum of £283,948, which is £94,936 less than the comparable figure in last year's accounts. This decrease is chiefly accounted for by a reduction in the Corporation's share of economies, and is due to difficult war conditions.

From the amount of £283,948 have been provided £24,305 for debenture redemption and £136,000 for taxation, leaving a net profit of £123,643, which, added to last year's carry forward (£54,250), makes a total available balance of £177,893 before charging war damage contribution.

Last year the whole of the war damage contribution, amounting to £80,000, was met from current revenue. This year the contribution amounts to £59,265, and the directors have decided, in view of the capital nature of the charge, to provide roughly half this sum by withdrawing £30,000 from the contingencies reserve which was created to meet unforeseen liabilities of this nature, and to charge the balance of £29,265 against current revenue. This leaves a sum of £148,628 for disposal, and the directors recommend a dividend for the year of 4½ per cent., less income tax, for the third year in succession, absorbing £112,500, and that the balance of £36,128 be carried forward.

* * *

Imperial Chemical Industries, Ltd.

The directors of Imperial Chemical Industries, Ltd., announce that they have declared, as at September 29, 1942, in respect of the trading year ending December 31, 1942, an interim dividend of 3 per cent. actual on the issued ordinary stock of the company.

This dividend will be payable (less income tax at the standard rate of United Kingdom income tax in force, reduced by Dominion income tax relief at 8d. in the pound) on December 1, 1942, to stockholders on the register on September 29, 1942.

* * *

Joseph Rank, Ltd.

The directors of Ranks, flour millers, have declared a further Ordinary dividend of 7 per cent., less tax, making 15 per cent., less tax, for the year to June 27 last, the same rate as last year. Dividend warrants were posted on October 22. Issued Ordinary capital is £3,461,699 in 5s. shares, which are quoted around 17s. 3d.

* * *

National Canning Company

The Eleventh Ordinary General Meeting of the National Canning Company, Limited, was held on October 1 at Wisbech, Mr. S. W. Smedley, chairman and managing director, presiding. In his statement, which had been circulated with the report and accounts for the year ended May 31, 1942, and was taken as read, the chairman said that the profits after all charges, including taxation, amounted to £50,647. The directors recommended the payment of a dividend at the rate of 10 per cent. less tax on the Ordinary shares and the transfer of £15,000 to the reserve account, leaving a balance of £63,949 to be carried forward. In arriving at the profit, provision had been made for all known and estimated liabilities, including E.P.T., Income-Tax, and War Damage Contribution.

At the end of his statement Mr. Smedley added a few words in support of others who in recent times have spoken of the importance of freedom in enterprise. Not so many years back they set out to build up a sound company which would supply a public want and in so doing also hoped to make a profit. Nowadays the idea of working for a profit is viewed in some quarters with grave disapproval, but there is no doubt that had the company been unable to retain profits in the past it would have been impossible to have built up the organisation existing to-day—an organisation which he ventured to think is of considerable use to this country at the present time.

It may be that when the war ends we shall need to submit to a further period of regulation, but it was his earnest hope that all controls will be abolished at the earliest possible moment, because he was utterly unable to envisage any bureaucratic system having sufficient flexibility to ensure that the men of enterprise who are coming along would be allowed reasonable freedom to develop their ventures.

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Chambers Wharf

Chambers Wharf and Cold Stores is doubling its final dividend at 10 per cent., making 15 per cent., less tax, on the £68,331 10s. Ordinary, against 10 per cent. The bulk of the company's refrigerated space is controlled by the Ministry of Food. This control carries with it a guaranteed minimum income. Ordinary wharfage and warehousing interests of the company are not affected. Issued capital is made up to £294,262 by £225,930 10s. of 6 per cent. Preference. The 5s. Ordinary are quoted 12s. 6d. and Preference (10s.) at par.

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Maynards

Maynards, the confectioners, is paying a dividend of 8 per cent., less tax, on its £389,600 Ordinary for the year to June 30, the same as for the previous year. The shares (£1) stand at 18s. 9d.

Information and Advice

Tagua Nuts

8,336. *Wanted, some general information about vegetable ivory, also called tagua nut, also references to the scientific literature.* (Scotland.)

Tagua or corozo nuts are obtained from the palm *Phytelephas macrocarpa,* which occurs principally in the tropical rain forest zone of Ecuador, Colombia and Peru. Commercial supplies come mainly from Ecuador. Though sometimes found at altitudes up to 3,000 feet, the tree is most abundant in the lower humid localities. It commonly forms grooves, in which it grows so closely as to suppress all other vegetation. The fruit is described as being as large as a man's head, and contains six to nine of the seeds or nuts, which measure about 2 inches in diameter. The fruits are left on the palm till they ripen and burst, allowing the nuts to fall. These are then collected from the ground and are dried in the open air, sheltered from sun and rain for three or four months, when they are ready for shipment.

Corozo nuts are the most important source of vegetable ivory. They are used principally for the manufacture of buttons, but are also employed in making various other kinds of small objects and ornaments. The material can be stained to various colours.

There are other palms which yield vegetable ivory nuts, principal among which are the Dom palms (*Hyphæne spp.*) that occur in Africa, particularly the Sudan, Eritrea and neighbouring parts. Dom nuts, however, are less valued than corozo nuts, on account of the cavity in the centre of the nuts, which limits their use to smaller objects than can be made from corozo nuts.

The waste material produced in the manufacture of buttons, etc., from corozo nuts is ground into meal and is used on the Continent for animal feeding, in admixture with other foods. It is largely carbohydrate in nature.

An article on tagua nuts appeared in *Foreign Commerce Weekly,* January 31, 1942, pages 6-7 and 32-33 (Washington, D.C.: U.S. Government Printing Office). Other more or less "popular" accounts of the nuts have appeared in various publications, but these mostly give little more information than is contained in this reply.

A comprehensive paper entitled "Chemical Composition, Digestibility and Feeding Value of Vegetable-Ivory Meal," by C. L. Beals and J. B. Lindsey, appeared in the *Journal of Agricultural Research* (U.S. Department of Agriculture), November 13, 1916, pages 301-319.

Malt Vinegar

8,331. *Wanted, a formula for making "malt vinegar".* (Sussex.)

The manufacture of malt vinegar is a highly technical process which could hardly be undertaken without expert knowledge. Briefly, the malt or malt and grain is crushed and heated in a mash tun with water at a gradually increasing temperature until the starch is converted into sugar by the diastase in the malt, the resulting liquor being known as wort, which is a product of brewing.

Often the wort is obtained by the conversion process, the grain, usually rice or maize and free from malt, is treated with dilute sulphuric acid in a closed vessel termed a converter. The acid hydrolises the starch to produce a saccharine solution, which is then freed from acid by calcium carbonate, and the liquor separated from the precipitated calcium sulphate. The wort is now pitched with yeast and is aerated and kept at the right temperature so as to convert as much as possible of the sugar into alcohol. The consequent strength of the vinegar depends largely upon the success of this stage, because all saccharine matter (also dextrines) escaping the action of the yeast also remain unattacked by the acetic bacteria. The resulting liquor, called gyle, which contains 6 to 7 per cent. of alcohol, is treated with acetic acid bacteria, the alcohol being oxidised to acetic acid. The acetifiers are specially constructed wooden vats. The finished vinegar flowing out of the acetifier is clarified by filtration, and as it leaves the filter it contains 6 per cent. of acetic acid and upwards.

Information Supplied

8,249. *Packing of pickled onions.* (Cumberland.)

8,257. *Literature of yeast extract.* (Lancs.)

8,259. *Use of sugar in meat-curing.* (Suffolk.)

8,262. *Use of dried egg yolk in mayonnaise.* (London.)

8,263. *Prevention of rancidity in mayonnaise.* (Scotland.)

8,265. *Jam-making.* (Eire.)

8,269. *Suppliers of code-marking machines for embossing code numbers on lids of small tins of food.* (Scotland.)

8,276. *Methods of pork and beef dehydration.* (Eire.)

8,277. *Suppliers of Calcium Carbonate Prec. B.P.* (Middlesex.)

8,282. *Instrument for measuring vacuum in cans of preserved milk.* (London.)

8,284. *Details of the supply of New Zealand Agar-Agar.* (Essex.)

8,285. *Addresses of suppliers of sodium glutamate, and also information about binders used with sausage filling.* (London.)

8,286. *Information concerning canned mushroom soups.* (London.)

8,288. *Information about the "Brunofix" process.* (Cheshire.)

8,290. *Formulæ for phosphate baking powders.* (Lancs.)

Information Required

8,347. *Good sources of supply of tin caps for pickle jars with ceresine wads, or the caps and wads separately.* (Worcs.)

8,357. *Building engineers with experience in planning of factory space and installations.* (London.)

Recent Patents

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Abstracts of Recent Specifications

An Improved Method of Preserving Meat

This invention has reference to the preservation of meat, and has for its object to provide an improved method by which meat—*i.e.*, butchers' meat, ham, bacon and the like—can be preserved by the process of pickling.

Meat is preserved by first immersing it in a pickling liquid for a few days, thereafter immersing it in a pickling liquid in a vessel from which air is extracted so that it is then subjected to reduced pressure, and after a short period, say half an hour, of this treatment, injecting pickling liquid into the meat by means of a hollow needle.

In carrying the invention into effect the meat, which may be in the form of a carcass or in the form of one or more pieces, is placed in a vessel containing sufficient quantity of pickling liquid to immerse the meat. The pickling liquid may be brine. The meat is allowed to steep in the pickling liquid for, say, three or four days.

The meat is then transferred to another vessel containing pickling liquid, and this vessel is connected to a pump by which the air is extracted therefrom, the pressure in the vessel being thereby reduced as far as is conveniently practical.

The meat is left in the vessel for about half an hour, the reduced pressure being maintained during this period.

Thereafter the meat is extracted from the vessel and pickling liquid under pressure injected into the meat by means of hollow needles. The meat is then preserved.

The inventor states that he is aware that it has been proposed to preserve meat by injecting a pickling liquid into it by means of hollow needles, then placing it in a vacuum container containing pickling liquid, in which it is submerged or in which it swims freely, then exhausting the air from the container and the air and/or gas occluded within the meat and maintaining the meat in the exhausted container for a period of time sufficient to complete the pickling operation. Further, in carrying out the aforesaid process, the meat may be subjected to the action of the vacuum before the injection of the pickling liquid.

547,051. Berka Heller.

Specifications Published

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

545,555. WALKER, CROSWELLER AND CO., LTD. (LEONARD VALVE CO.): Fluid-mixing devices.

545,557. FOX, A. E.: Evaporation of sugar and like solutions.

545,630. AFRICAN SISAL AND PRODUCE CO., LTD., WALSH, C. L., and MAY, J.: Chemical treatment of vegetable matter for extracting substances suitable for use in foodstuffs, finings for beer, and the like.

545,686. STEVENS, A. H. (MECHANICAL RESEARCH, INC.): Methods of and apparatus for freezing food products.

545,687. WALKER, M. A., and GENERAL ELECTRIC CO., LTD.: Separation of materials of different specific gravities.

545,710. TEMPLETON, R. A. S., and FARMERS' MARKETING AND SUPPLY CO., LTD.: Method and means for drying vegetables, especially potatoes or other food products.

545,715. NOONE, E.: Urns for tea and other beverages.

545,733. HALSTEAD, P. E.: Oil filters.

545,741. WEAKLEY, F. J., and CHAPMAN, F. C.: Steam generators.

545,781. DISTILLATION PRODUCTS, INC.: Vacuum distillation.

545,782. PEARSON (BIRMINGHAM), LTD., J. R., and PAINE, J.: Sterilising tanks.

545,800. LAING, J.: Closures for fruit-preserving jars.

545,821. SYLVANIA INDUSTRIAL CORPORATION: Preservation of wrapped food by freezing, and the products so produced.

545,829. HOLLAND, L. G.: Boiler and like furnaces.

545,832. STANDARD OIL DEVELOPMENT CO.: Measurement of temperature.

545,833. ELLIS, H. S., and NEWHAVEN ENGINEERING CO., LTD.: Air conditioners.

545,844. MORGAN, J. S., and GAMMON, J. C.: Apparatus for the estimation of moisture in granulated solids.

545,869. PERMUTIT CO., LTD.: Method of treating water for the purpose of removing electrolytes therefrom.

545,870. KLEENTAINERS (BRITISH AND OVERSEAS), LTD., and WARE, H. M.: Sealable bottles and like containers composed of paper, wood-pulp, or like sheet material.

545,888. HARBER, L. S., and BAKER PERKINS, LTD.: Delivery of dough pieces and other articles.

Trade Marks

The list of trade marks of interest to readers has been selected from the "Official Trade Marks Journal" and is published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

FLOTEXA.—618,129. Edible oils and fats and cream (for food). **William Wilson Brown,** 27, Ratcliffe, Terrace, Edinburgh; Manufacturer and Merchant.

GUSTALEX.—618,130. Edible oils and fats and cream (for food). **William Wilson Brown,** 27, Ratcliffe Terrace, Edinburgh; Manufacturer and Merchant.

CITAVANNA.—618,272. Confectionery, ice cream and ice cream powders. **The Scottish Flavour and Colour Co., Ltd.,** Mayfield Works, 27 to 29, Ratcliffe Terrace, Edinburgh; Manufacturers and Merchants.

FREEZAVITA.—618,315. Confectionery, ice cream and ice cream powder. **William Wilson Brown,** 27, Ratcliffe Terrace, Edinburgh; Manufacturer and Merchant.

New Companies

Northern Dairies (Middlesbrough), Limited. (375762.) 1a, Keay Street, Middlesbrough. Nom. cap.: £500 in £1 shares. Dirs.: To be appointed by the subs. Subs.: H. M Morrow, 34, Bradbury Road, Norton-on-Tees; F. E. Holroyd, 5, Park Square, Leeds (acct.).

Superfine Oils and Products Company, Limited. (375765.) 5, Verulam Buildings, Gray's Inn, W.C. 1. Nom. cap.: £500 in £1 shares. Dirs.: A. W. Hall, 25, Merewood Road, Barnhurst, Kent; Mary N. Hall, 25, Merewood Road, Barnhurst, Kent.

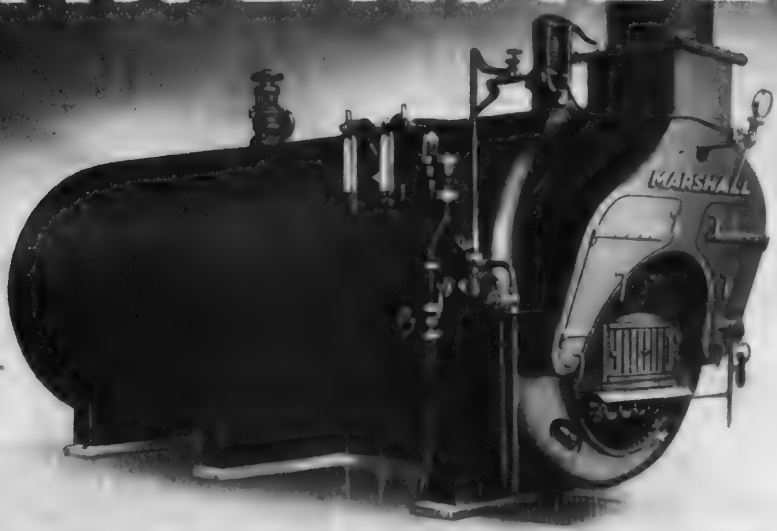
G. and J. Burton, Limited. (375776.) 59, Abingdon Street, Blackpool. To carry on bus. of bakers, confectioners, etc. Nom. cap.: £3,000 in £1 shares. Dirs.: J. B. Burton, 4, Knowsley Avenue, Blackpool; P. J. Oliver, Walmsley, Broadway, Morecambe.

Kerswell and Monk Pig Farm, Limited. (375786.) Nom. cap.: £500 in £1 shares. Dirs.: To be appointed by subs. Subs.: Alice Bennett, 74, Tanfield Road, Croydon, Surrey (clk.); Mrs. A. F. Osborn, 45, The Drive, Potters Bar, Mdx.

Olivers (of Lancaster), Limited. (375789.) 11, Penny Street, Lancaster. To carry on bus. of bakers, confectioners, etc. Nom. cap.: £3,000 in £1 shares. Dirs.: P. J. Oliver, Walmsley, Broadway, Morecambe; J. B. Burton, 4, Knowsley Avenue, Blackpool.

Taken from the Daily Register, compiled by Jordan and Sons, Limited, Company Registration Agents, 116, Chancery Lane, London, W.C. 2.

MARSHALL



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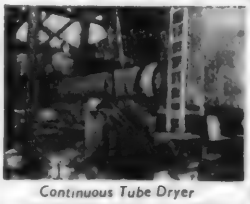
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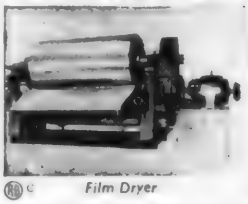
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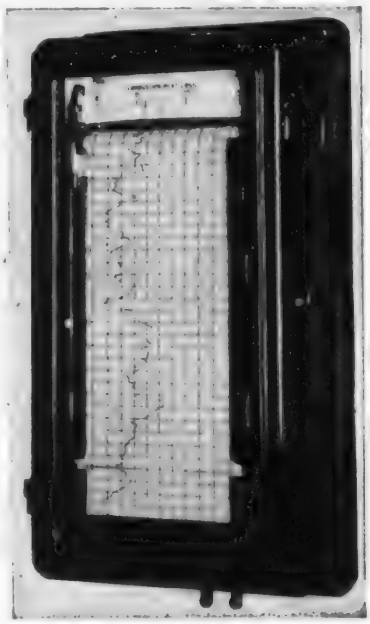

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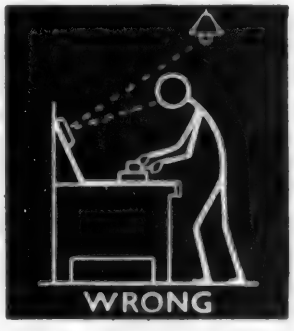

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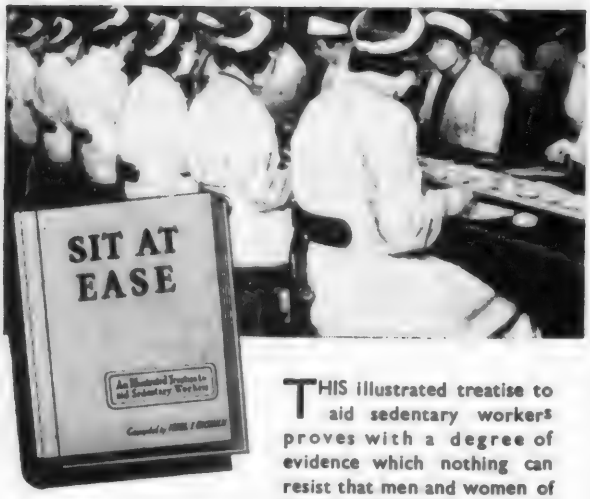

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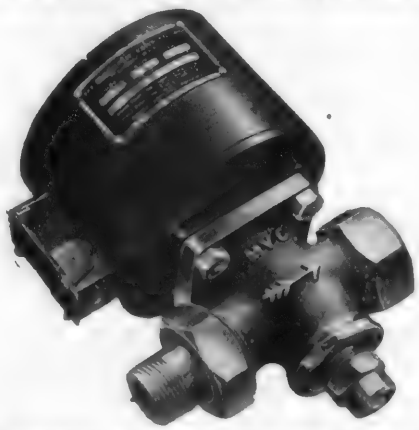

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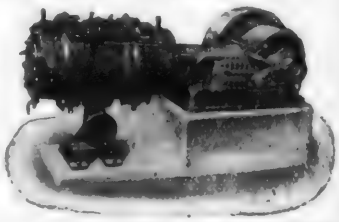

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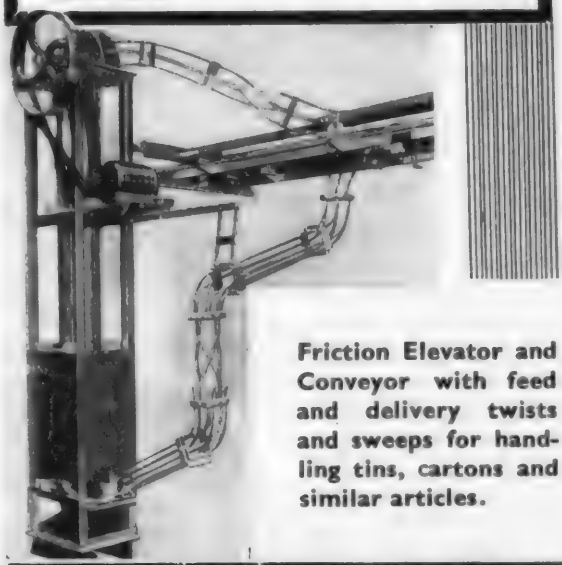

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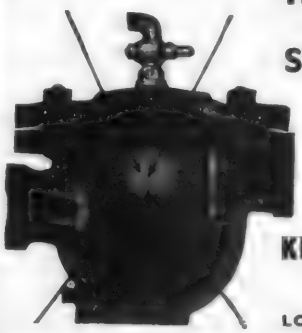

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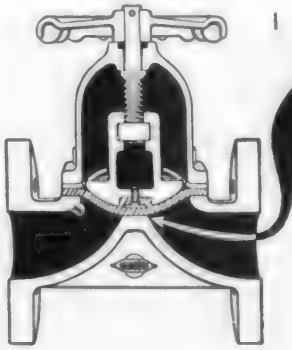

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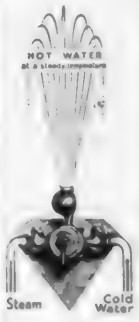

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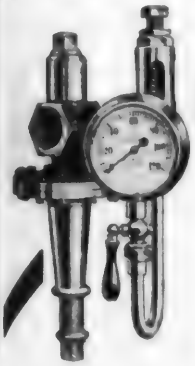

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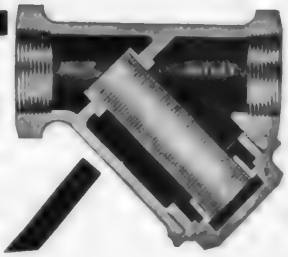

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A COMPETENT Works Manager is required. — See full details on page lxix.

A LARGE industrial concern manufacturing food products has vacancies in its research laboratory for two senior research managers. Applications are invited from experienced scientists capable of directing the work of a research group of about 30 workers. Age preferably 35-45. Salary according to experience, but not exceeding £2,000 per annum. Successful candidates may commence their duties immediately or at the conclusion of hostilities if at present engaged on war work.—Box B501, *Food Manufacture*, 17, Stratford Place, London, W.1.

FACTORY Manager, over military age, required, with full knowledge of Fruit and Vegetable Canning, preferably with knowledge of jam manufacture, pulping and brining; and with general mechanical knowledge. Experienced in handling staff and labour; knowledge of trade buying; accounting and costing experience an asset; transport experience helpful. State salary required.—Box B503, *Food Manufacture*, 17, Stratford Place, London, W.1.

FOOD Chemist, experienced in Dairy Food Processing and in Bacteriology. First-class opportunity for young man with the necessary qualifications, and possessing initiative and ambition.—Please reply fully, in confidence, to Box B462, *Food Manufacture*, 17, Stratford Place, London, W.1.

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CHEMIST, 29, University Degree, long experience and thorough practical knowledge of Bakers' Sundries, also substitutes, seek suitable position.—Box B449, *Food Manufacture*, 17, Stratford Place, London, W.1.

EXPERIENCED Supervisor small plant for soup and meat canning seeks position as Assistant Manager in large factory. Knowledge chemistry, biology and cooking.—Box B497, *Food Manufacture*, 17, Stratford Place, London, W.1.

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FOODSTUFF manufacturers having acquired factory, storage, and cold store for Sector 1, would be interested in additional lines for bakers, restaurants, and general grocery. Would consider representation or arranging storage and distribution facilities.—Box B508, *Food Manufacture*, 17, Stratford Place, London, W.1.

GRINDING, Screening, Mixing, any quantity undertaken.—Hommel's Hæmatogen and Drug Co., 121, Norwood Road, Herne Hill, London, S.E.24.

OLD-ESTABLISHED Bakery Company would like to get into touch with food chemist who could suggest and produce some products capable of manufacture in bakery for after-war development.—Box B509, *Food Manufacture*, 17, Stratford Place, London, W.1.

SPRAY Drying. Advertisers are looking for firm having surplus spray-drying capacity and willing to dry products for them in small or larger quantities according to capacity available.—Box B504, *Food Manufacture*, 17, Stratford Place, London, W.1.

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JEWEL Steam Turbine Centrifugal Fat Extractor, 22-in. basket. Disintegrator Gripding Unit, hopper feed, fan delivery. 32-in. Steel Jacketed Pan. Vertical Steam Boiler 9½ ft. by 4 ft.—A. H. Kimmins and Sons, Lyndhurst Road, Worthing.

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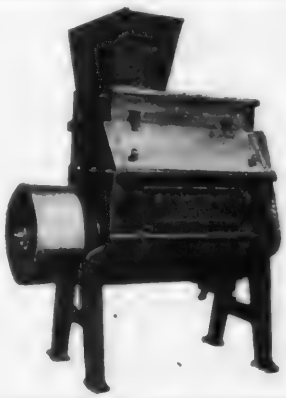

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Vertical Cast-Iron Unjacketed totally enclosed Mixer; vertical agitating gear driven through totally enclosed worm gearing from f. and l. pulleys; pan 6 ft. dia. inside by 3 ft. 6 ins. deep; cover fitted with manhole; pan arranged with bottom run-off; four side feet for mounting.

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36 ins. dia. Hydro Extractor by Broadbent; vulcanised copper basket 36 ins. dia.; underdriven by belt from countershaft.

Five Copper Steam-Jacketed Tilting Pans, mounted on cast-iron stand and arranged with steam through trunnion bearings; capacities up to 40 gallons.

Edge Runner Mill; cast-iron pan 2 ft. 9 ins. dia. by 6 ins. deep; stationary cast-iron rolls 18 ins. dia. by 8 ins. face; underdriven through bevel gearing from f. and l. pulleys; complete with scrapers and belt striking gear.

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DISINTEGRATOR GRINDING UNIT, agitated hopper feed, fan delivery, belt drived. Iwel Turbine Centrifugal Fat Extractor, 22-in. basket. 32-in. dia. C.I. Jacketed Pan. Vertical Steam Boiler, 6 ft. by 2 ft. 6 ins., 60 lbs. w.p. Hand Current Cleaning Machine, 12-in. Porthole A.C. Electric Fan, 200/1/50.—A. H. Kimmins & Sons, Lyndhurst Road, Worthing.

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REQUIRED—Walker-Wallace, U.D.E.C., or similar Can Washer, capacity 3 cans per minute, or upwards.—Offers to Engineering Dept., Central Buildings, Guildford.

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WANTED—large capacity gas-heated Coffee Roaster with cooler.—Advise lowest price and where it may be inspected to Box B494, *Food Manufacture*, 17, Stratford Place, London, W.1.

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WANTED, Second-Hand Wrapping Machines to Handle Blocks 1¾ ins. by 1¾ ins. by 1 in. Offers of machines which would require alteration will be considered.—Full details to Box B466, *Food Manufacture*, 17, Stratford Place, London .W.1.

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WANTED, Roller Dryer.—Details of construction, capacity, price to Box B446, *Food Manufacture*, 17, Stratford Place, London, W.1.

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BRINE-MIXING and storage tanks, preferably with coils, approx. 250 gallons, of brine-resisting metal, or M.S. suitable for lining.—A. W. Foster and Co., Ltd., Bardney, Lincoln.

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WANTED, small Refrigerator or Ice Cream Maker. — Box B511, *Food Manufacture*, 17, Stratford Place, London, W.1.

"PRINCIPLES of Fruit Preservation," by T. N. Morris. Second-hand volume of this is urgently required.—Give details of price, condition, date of publication to Box B484, *Food Manufacture*, 17, Stratford Place, London, W.1.

PATENTS

THE Proprietor of British Patent No. 509389, dated February 28, 1939, pertaining to "Improvements in or relating to the manufacture of Cheese," is desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain.—Inquiries to Singer, Ehlert, Stern and Carlberg, Steger Building, Chicago, Illinois.

PATENT No. 502,609 "Improvements in the manufacture of milk soluble alginate compounds." The owners of the above patent are desirous of arranging by licence or otherwise on reasonable terms for the manufacture and commercial development of the invention. For particulars address in the first instance to Herbert Haddan and Co., 31 and 32, Bedford Street, Strand, London, W.C.2.

THE proprietors of British Patent No. 493,103, dated March 30, 1937, relating to "Improvements in process of producing aerated expanded food products," are desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain. Enquiries to Singer, Ehlert, Stern and Carlberg, Chrysler Bldg., New York City, N.Y., U.S.A.

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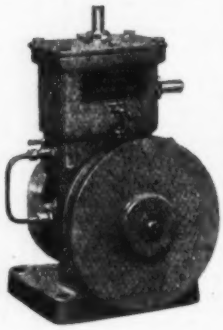

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